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MACHINERY

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The Production of VDF Standard Lathes P. 412

In this second article concerned with the practice of the German firm Heidenreich & Harbeck, Hamburg, which is a member of the VDF group, attention is drawn to the effective use which is being made of Burgsmuller thread whirling heads for cutting lead screws. This method, it is stated, is six times as fast as conventional thread milling. The subsequent finishing operations are carried out on precision lathes of the company's own design. Reference is also made to the hardening of bed-ways by the high-frequency induction method, and to typical set-ups on radial drilling machines for handling beds and other components. An interesting application is also described whereby a milling attachment, a special work-head, and a VDF Unicop copying unit on a standard lathe, are employed for profile milling a cast-iron selector plate. The care taken by the company in maintaining a high standard for the machine tools which they build is indicated by the procedures adopted for gauge checking, for which interesting equipment has been developed, also by the facilities that are provided for testing and development work. (MACHINERY, 92—21/2/58.)

Quantity Production of Motor Car Bumpers ....P. 421

Motor-car bumpers are made in large numbers by the Electric Auto-Lite Co., U.S.A. After roller-levelling treatment, the steel sheets are flat-polished on a 100-ft. long machine with 16 stations. Next, they are phosphatized and soap coated in preparation for the blanking and drawing operations. Press operations vary somewhat for different bumper designs, but as a rule, drawing is followed by trimming, flanging, re-striking, and piercing. Subsequently, the bumpers are contour polished, first on a "roundabout" installation and then with straight-line equipment. Polished bumpers pass to automatic cleaning and nickel-plating lines, and the nickel coating is then buffed by methods that are similar to those employed for the contour polishing operations. Finally, the bumpers are cleaned, etched, and chromium plated. (MACHINERY, 92—21/2/58.)

Grinding Chain Rivets to Close Limits P. 426

At the works of Aktiebolaget C. E. Johansson, Sweden, rivets for cycle chains are ground to close limits of accuracy on a hopper-fed Malcus centreless machine provided with Deltameter gauging equipment. A blade-type steady, above the carbide-faced work rest of the machine, prevents bouncing of the workpieces. Rivets leaving the centreless grinding machine pass down a tube to the gauging equipment, and as only a proportion of the total throughput is gauged, an overspill arrangement is provided, so that the remainder of the workpieces can by-pass the gauge and fall directly into a bin. (MACHINERY, 92—21/2/58.)

Interesting Set-ups on Tarex Automatics P. 428

Some demonstration set-ups on Tarex machines at the Fifth European Machine Tool Exhibition at Hanover, are here described. On one machine, a hydraulic copying attachment is employed for rough-turning a complicated internal form, various important diameters and faces then being finished by turret tooling. Another machine is equipped with a Ward-Leonard set which affords facilities for readily varying spindle speed, so that constant cutting speed can be maintained for facing operations. The third machine is equipped for automatically loading a cast-iron pulley on which turning, facing, grooving, drilling, and boring operations are performed. (MACHINERY, 92—21/2/58.)

Machining Crankshafts with Carbide Tools on Single-purpose Lathes...............P. 443

For machining the crankpins of forged steel motor-car crankshafts with cemented carbide tools, the Pontiac Motor Division, General Motors Corporation, U.S.A., have installed a group of four single-purpose Wickes lathes. Each lathe is powered by a 60-h.p., D.C., variable-speed motor, and the workpieces are driven from each end. A three-to-one speed range is available which enables facing and plunge-forming to be carried out at a cutting speed of 250 ft. per min. The operating cycle of each machine in the line is independent and automatic. By means of a mechanized transfer system, each shaft is advanced to the first machine, and transported from one machine to another in the line. Two cutting tools are provided on each lathe, and are applied to the work from the front and rear, by means of a hydraulic cylinder acting through a cam bar. Each front tool has two circular and one triangular insert, and each rear tool two triangular inserts. (MACHINERY, 92—21/2/58.)

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IN FORTHCOMING ISSUES

The production of components for Lambretta motor scooters—Methods and equipment for checking tapers—Die casting of Necchi sewing machine components.

The Extending Field for Ultrasonics

It is only in comparatively recent years that vibration at ultrasonic frequencies has been turned to practical account in the engineering industry, but as a result of the rapid development of equipment for the convenient generation and practical application of these high frequency vibrations, this new technique is constantly assuming increasing importance for a growing variety of purposes. One of the earliest reported applications was for the preparation of aluminium wires for soldering by immersion in a bath of mercury, which was subjected to vibration and served to remove the oxide layer from the surface.

Since that time, equipment has been introduced whereby the principle can be more directly and effectively applied in aluminium soldering operations, and this process is already well established. The advantages of ultrasonic vibration as an aid to the thorough cleaning of intricate metal parts in solvent baths have also been fully demonstrated. In many precision assemblies the presence of even minute quantities of foreign matter may be highly detrimental, and the searching action of a liquid subjected to high frequency agitation ensures a standard of cleanliness that would be very difficult to achieve by other methods.

Ultrasonics have, of course, also been turned to good account for the purpose of non-destructive testing which continues to assume increasing importance for many components and structures where the presence of internal flaws cannot be tolerated. Here, again, special equipment has been introduced whereby a variety of components can be thoroughly inspected, either in course of manufacture or for the detection of defects that may have developed in service. A particular advantage of the method is that flaws may be revealed in metal of thicknesses beyond the capacity of X- or gamma-rays, and it is obviously of great value if large die blocks, for example, can be checked before expensive machining operations are carried out.

Another application of ultrasonics, and one of particular interest to the production engineer, is for machining operations, principally on hard and brittle materials, which may otherwise be difficult or almost impossible to perform. The process can, moreover, be applied to both metallic and non-metallic materials since electrical conductivity is not essential. There is still a tendency to associate ultrasonic machining principally or entirely with the production of holes or cavities of non-circular cross section in such materials as tungsten carbide. Certainly the ability to perform such operations is of great importance, but they do not, by any means, exhaust the possibilities of the method. It may be noted, for instance, that results alien to those of surface grinding can be obtained by reciprocating the workpiece beneath the tool as it is fed downwards. Materials such as silicon, germanium, and sapphire may be sliced by means of a multi-blade tool and subsequently cut into dice or roundels for use in transistors or diodes, or for the preparation of bearing jewel blanks. Other operations which have been successfully performed include the "blanking" of shaped parts from Ferramic sheet, and the piercing of accurate ports in steel valve sleeves.

Ability to produce internal screw threads in very hard materials is sometimes an advantage, and this operation can be performed by the ultrasonic method. In this connection, as was recently reported in MACHINERY, one company claims to have obtained improved results by mounting the tool horizontally on a stub of special form. The same company has reported that greatly increased rates of penetration have been obtained, for certain drilling operations, by interposing a mechanical transducer in the mounting for the tool, to obtain vibrations of increased amplitude. Another development which has lately been announced is concerned with the drilling of small holes, for instance in ferrite cores. For a particular size of hole, a brass wire of 0·013 in. diameter is employed for drilling, and it is stated that better results are obtained by allowing this wire to rotate, in a clearance hole in the holder, under the influence of the vibration.

Among the more recent applications of ultrasonics is cold welding and it is understood that this process is already being employed on production work at several factories in the U.S.A. In an article published in a recent issue of *The Tool Engineer*, it is explained that, with the two thicknesses of metal to be joined clamped comparatively lightly between welding tips, the application of the high frequency vibration causes them to weld within 1 sec. This effect has not yet been fully explained but it has been established that, although

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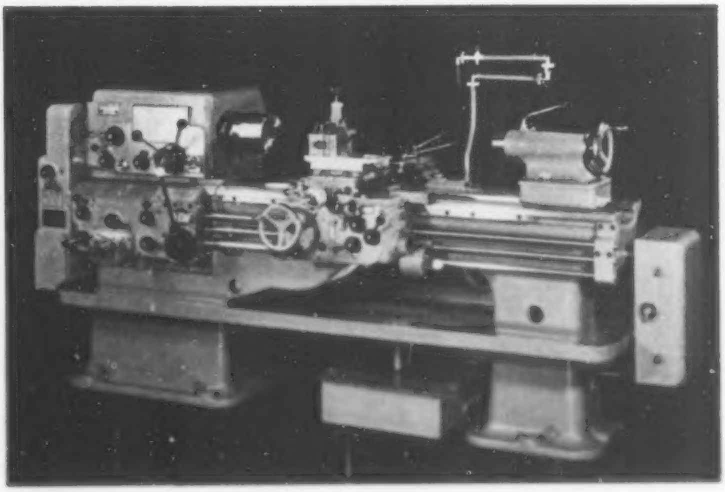
The Production of VDF Standard Lathes

Some Details of the Methods Employed at the Works of Heidenreich & Harbeck, Hamburg



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PRODUCTION OF LEAD SCREWS

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In Fig. 1 and 2, the lathe is seen set up for cutting a 32-mm. (1¼-in.) diameter by ¼-in. pitch screw. A cutting speed of 600 ft. per min is employed, and the time for producing the 40-in. length of thread is 45 min. A finishing allowance of 0·008 in. is left on each flank, and 0·004 in. on the bottom of the thread. For cooling the tools, compressed air is taken from the shop line, and delivered through the jet pipe *E*, Fig. 2. As will be appreciated, the use of a liquid coolant would be inconvenient in view of the fact that a setting

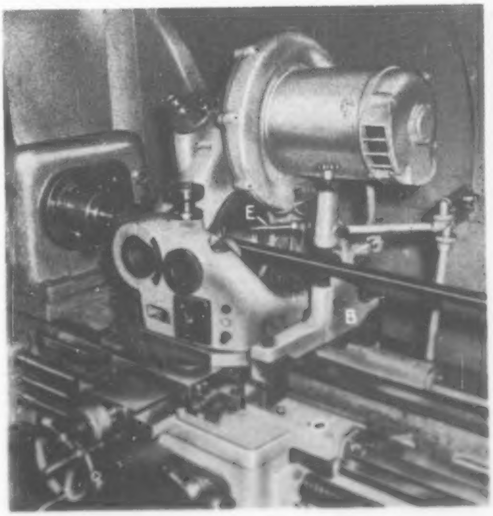

Fig. 2. The Burgsmuller Thread Whirling Attachment Viewed from the Tailstock End of the Lathe

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The Production of VDF Standard Lathes

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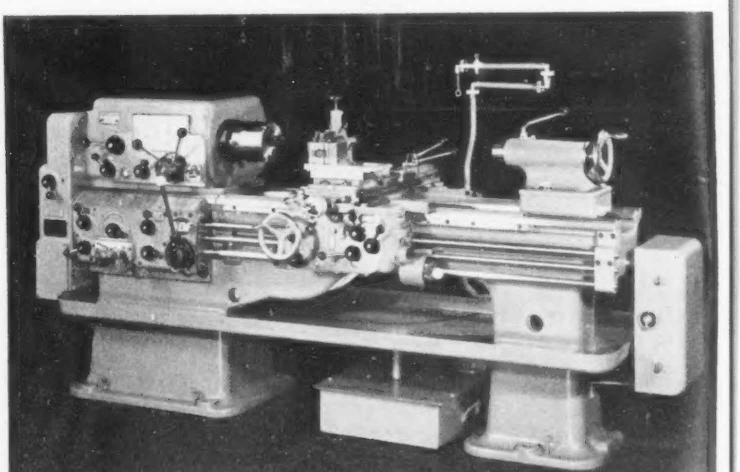

An article has already been published in MACHINERY, 92/232—31/1/58, describing some of the methods which are employed for the production of lathes at the works of Heidenreich & Harbeck, Hamburg. This company is a member of the VDF group, which is now one of the largest organizations in Germany engaged in building precision machine tools. VDF lathes, it may be noted, are sold in this country by Sykes Machine Tool Co., Ltd., The Hythe, Staines, Middlesex. In the earlier article, reference was made to two hydraulically-operated, special-purpose machines designed and built by the company for performing boring, facing, drilling, reaming and tapping operations on headstocks, gearboxes, and aprons, also to the techniques employed for finishing headstock and tailstock spindle bores. Some details were given of equipment developed for the induction hardening of gear teeth, and attention was drawn to an extensive installation of gear grinding machines, and to the flow-line methods employed for assembling headstocks, gearboxes and aprons. Other noteworthy techniques are considered in this article.

The smallest centre lathe in the VDF standard range, namely the type 18RO, of 7-in. centre height, is shown in the heading illustration. This lathe, it may be noted, also the type 21RO, of 9-in. centre height, and the S type lathes, can be fitted with high-speed headstocks.

PRODUCTION OF LEAD SCREWS

The lead screws and cross-slide screws of VDF lathes are produced from 0·45 per cent. carbon, centreless ground steel bar, and for rough machining the threads after the necks have been turned at each end, the company are obtaining good results with Burgsmuller type L3 thread whirling attachments on standard centre lathes, also on thread milling machines where they have been substituted for the original cutter heads. Thread whirling has been found to be nearly six times as fast as thread milling, although the latter method is still used to a certain extent.

Views from the headstock and tailstock end of a VDF centre lathe equipped with one of these attachments are given in Fig. 1 and 2. The technique of thread whirling is now well established, and has been the subject of various articles in MACHINERY. Briefly, the thread is cut by inwardly projecting tools mounted in a head *A*, Fig. 1, which is rotated rapidly, on an offset axis, about the workpiece. The latter is rotated slowly, and the lathe carriage is traversed along the bed at a suitable rate, according to the pitch of thread required.

The workpiece is gripped in a collet and is supported at the opposite end by a non-rotating tailstock centre. A 3-point travelling steady *B* is provided on one side of the carriage, and the work

passes through a support bush in a bracket C, Fig. 1, which is bolted to the opposite side. Three tungsten-carbide tipped tool-bits are provided in the rotating head, one of which removes the metal from the centre of the thread form, while the other two take cuts on the right and left-hand flanks to complete the thread at a single pass. The cutter head, which is mounted in pre-loaded ball bearings, is driven by V-belts from a motor of 10 h.p., and the ring-shaped holder carrying the tool-bits can readily be removed, and replaced by another already set up, when the tools require resharpening. A Leitz microscope of 10 × magnification, which can be fitted with graticules for different thread forms, is incorporated at D, to facilitate accurate tool setting, and for inspecting the thread form on the work.

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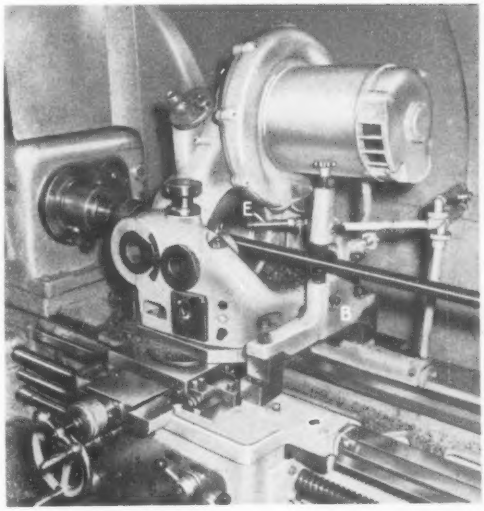


Fig. 2. The Burgsmuller Thread Whirling Attachment Viewed from the Tailstock End of the Lathe

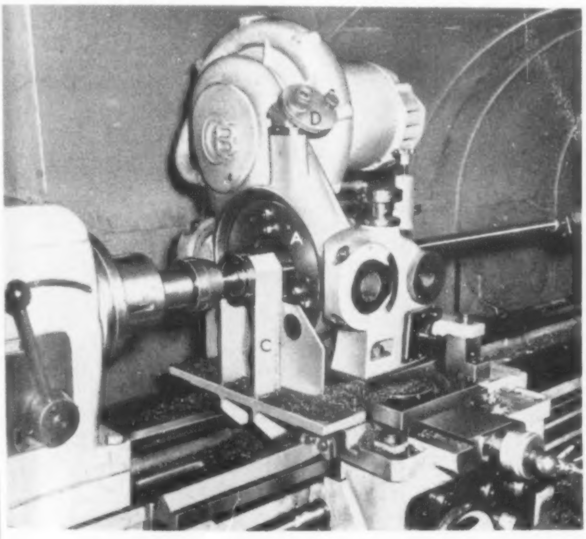


Fig. 1. View, from the Headstock End, of a VDF Lathe Fitted with a Burgsmuller Type L3 Thread Whirling Attachment for the Production of Lead Screws

Threads are finish cut in special lathes of the company's own design and construction, one of which is shown in Fig. 3. Features of this lathe include adjustable bronze bearings for the headstock spindle, which is only required to rotate fairly slowly, very long vee and flat guideways for the carriage on the bed, and location of the master lead-screw between the bed-ways to provide a centralized thrust. It may be noted that the lead-screw is supported from beneath along its entire length by radiused blocks of lignum-vitae, mounted in the bed.

Carried between centres and rotated by a conventional-type driver, the workpiece is supported at each side of the cut in hardened steel bushes which are passed over it before it is loaded, and are held in swing-cap brackets A and B, bolted to the carriage. In addition, there are fixed steadies on the bed, which are moved by the operator from the headstock to the tailstock side of the carriage as the latter is traversed along. Front and rear ground form

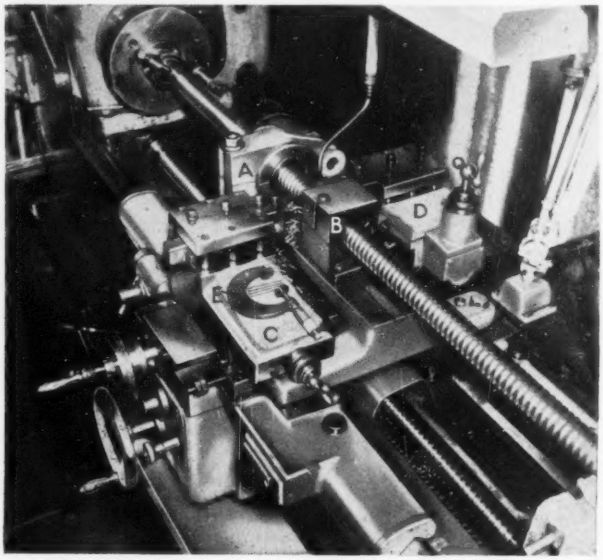


Fig. 3. One of the Special VDF Lathes Employed for Finishing Lead Screws

tools of high-speed steel are employed, and are located square with the work axis by abutment faces on the screw-operated top slides *C* and *D*. The front tool is in operation when the carriage is traversing towards the headstock, and the rear tool is employed to take a further cut during the return movement. Six roughing cuts are usually taken on the flanks followed by three or four finishing cuts, and the root diameter is finished separately.

Before the operation is started, and between the roughing and finishing stages, the work is checked for straightness with the aid of a dial gauge, and correction is made, as required, by means of a bar which is used in conjunction with a fulcrum block. A controlled flow of Vacuum Sultran C oil provides for cooling, and for the 45-mm. diameter (1·772-in.) screw shown, roughing cuts are taken at a speed of 47 r.p.m. and finishing cuts at 30 r.p.m. As a rule, one pair of tools can be used for the roughing operation on two lead screws, and freshly-ground tools are employed for the finishing operation on each screw. Lighting is provided by a fluorescent fitting which travels with the carriage. This form of illumination does not produce the heat associated with a normal filament lamp, which might affect the accuracy of the work.

Precision lathes of the design shown are installed which are capable of handling lead screws up to 10 ft. long, and for a screw of this size, about eight hours are required for the various stages of finishing the thread. Effective diameter is checked during the lathe operations by the three-wire method, using the micrometer seen at *E*, which is

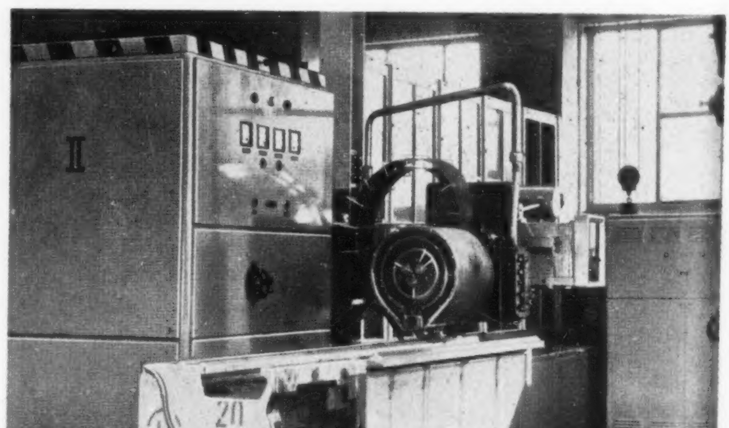


Fig. 4. High-frequency Induction Heating Equipment Developed for Hardening VDF Lathe Beds

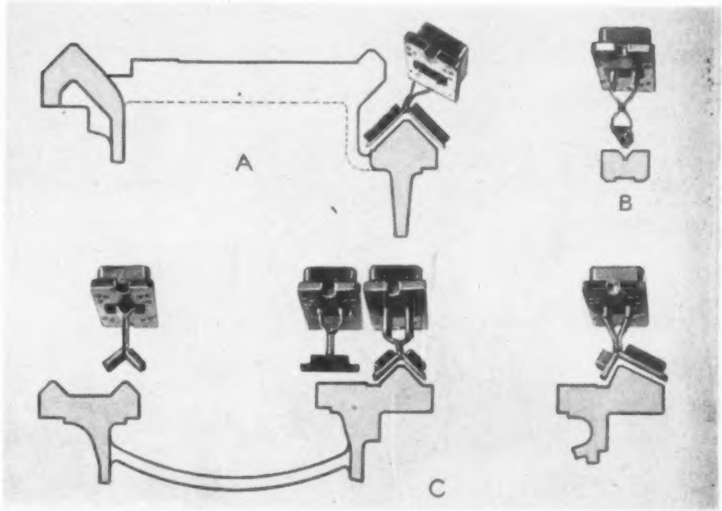


Fig. 5. Some of the Inductors Employed for Hardening Lathe Beds. A—Turret Lathe Bed. B—Ball Guideway. C—Centre Lathe Beds

fitted with button anvils. The final tests, carried out in a temperature-controlled room, include checking for accuracy of pitch along the whole length of the screw, on a Carl Zeiss machine.

VDF standard lathes are normally fitted with lead-screws which are accurate for pitch to ±0·03 mm. per 300 mm. (Schlesinger standard for general-purpose lathes). If required, however, a lead-screw with a pitch accuracy of ±0·02 mm. per 300 mm. can be provided, which corresponds to the Schlesinger standard for toolroom lathes. If even greater precision is necessary, a screw accurate to ±0·01 mm. per 300 mm. can be supplied.

With the object of expediting the finishing of lead screws, the company are considering the design and construction, in their own works, of a thread grinding machine, which will be installed in a temperature-controlled room.

HARDENED AND GROUND BEDS

As mentioned in the previous article, the company operate their own foundry, which is situated about 40 miles from Hamburg, and here, for convenience, certain of the preliminary machining operations are performed on the heavier castings, including headstocks and beds. The latter, if required, can be supplied with the ways hardened by the high-frequency induction heating method to 450/500 Brinell, and this operation is also carried out at the foundry, with the equipment seen in Fig. 4, which was developed by the company in conjunction with the German firm Schoppe & Faeser G.m.b.H. This equipment operates on a frequency of 300,000 cycles per sec., and depth of hardness, after the bed has been ground, is 0·030/0·040 in. The inductor head is traversed above the stationary bed, and some of the inductors employed are seen in Fig. 5. The installation has been in operation for a period of about five years.

Rough grinding of the beds is also carried out in the machine shop associated with the foundry, and the beds are then transported to the main works, where they are finish ground. Way grinding is performed largely on Billeter travelling-wheelhead machines, but mention may also be made of a technique which the VDF company have developed, whereby the operation is carried out with a portable precision grinding unit arranged to travel along the bed itself, location being taken from a previously finish-ground datum surface.

A set-up for drilling operations on beds, on a Raboma radial machine, is shown in Fig. 6. Here, the bed casting is held at each end in a trunnion mounting provided with wheels, so that it can be moved along rails which are sunk into the floor and extend through the shop. The clamping members *A* and *B* can be replaced by others to suit different type of beds, and an index plate *C*, located by a spring-loaded detent, enables drilling to be carried out at various angular positions. Plate-type jigs, located and clamped directly on the work, as seen at *D*, are employed, which, in conjunction with the facility for movement along the rails, enable operations on long beds to be very conveniently performed.

In connection with radial drilling operations, it may also be mentioned that extensive use is being made of rotary indexing tables of the type shown in Fig. 7, which were supplied by J. Gottlieb Peiseler, Remscheid. The 40-in. diameter, T-slotted face plate is rotated by worm and worm-

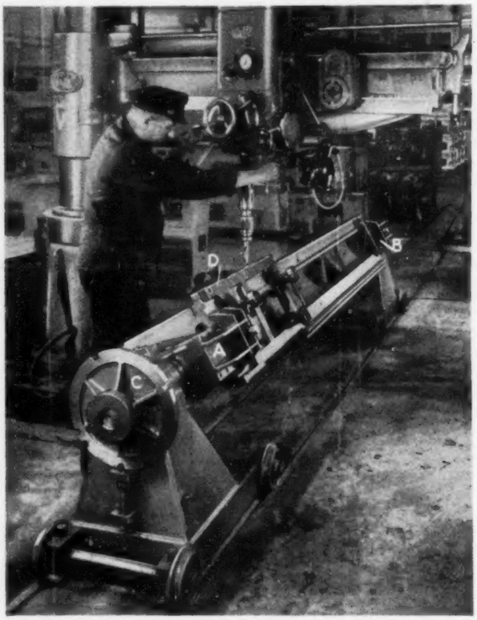


Fig. 6. Set-up on a Raboma Radial Machine for Carrying Out a Series of Drilling Operations on a Lathe Bed

wheel, and the company also employ the units, in conjunction with outboard trunnion bearings, for supporting and indexing long, heavy jigs.

PROFILE MILLING ON A LATHE WITH UNICOP CONTROL

Details have already been given in MACHINERY, 90/935—26/4/57, of some effective applications of a universal milling and grinding attachment, which is available for use on VDF lathes. Fig. 8 and 9 show an interesting set-up on a VDF centre lathe in the company's works, which incorporates one of these attachments, also a special work-head and a Unicop copying unit for profile milling a cam form in the face of a cast iron selector plate. This component is part of a lathe headstock speed change mechanism.

Referring to Fig. 8, the work-head *A* has two spindles, one of which carries the casting *B*, to be milled, and the other, a master *C*, of the cam form required. Drive to the master spindle is taken through gears of 1·1 ratio from the front of the work spindle, and the Unicop stylus unit *D* is mounted on a bracket at the rear of the lathe cross slide. The milling attachment seen at *E* is carried at the front of the cross slide. A vertical adjustment, by hand, of $9\frac{7}{16}$ in. is provided for the swivelling spindle head, and the drive is taken from a motor of $\frac{3}{4}$ h.p. Six spindle speeds from 56 to 560 r.p.m. are available, and for the application illustrated the highest speed is employed. The cam form in the workpiece is 16 mm. (0·630 in.) wide by 9 mm. (0·345 in.) deep, and it is produced at roughing and finishing operations. For roughing, a high-speed steel end mill of reduced diameter is employed, which leaves a finishing allowance of about $\frac{1}{32}$ in. per side, and each operation is completed in a total machining time of about 7 min.

Drive to the work spindle is transmitted by a universally-jointed shaft *F*, Fig. 9, from the headstock spindle, and then through reduction gears in the head indicated at *A*. When the work and master spindles have rotated through the required angle, the drive is automatically disengaged, and provision is made for rotating the spindles by handwheel back to the starting position, in preparation for milling the next workpiece. An adjustable micrometer stop *G*, on the bed, enables

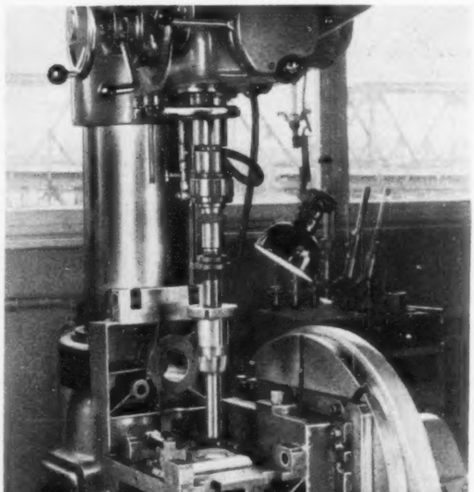


Fig. 7. An Application, on a Radial Drilling Machine, of a Rotary Table Supplied by J. Gottlieb Pieseler

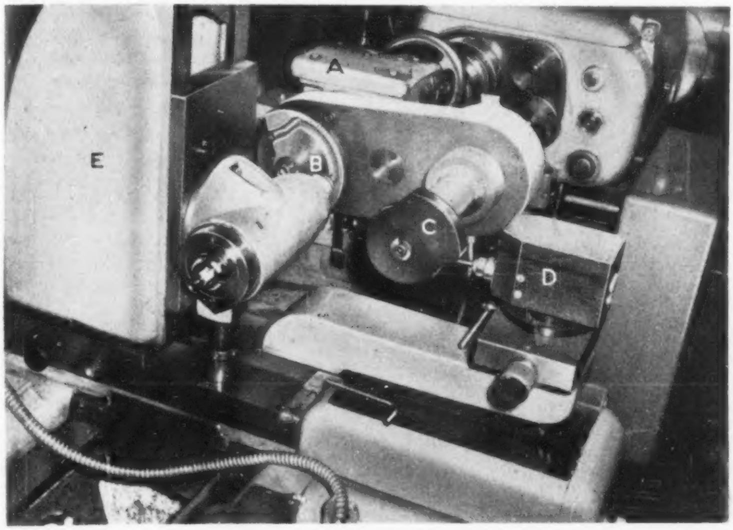


Fig. 8. Set-up Incorporating a Special Work Head and a Universal Milling Head for Producing a Cam Form in a Selector Plate on a VDF Lathe Fitted with a Unicop Copying Attachment

the cutter to be set accurately for depth at the start of the operation. Location for the work-head is taken from the vee and flat bed-ways.

GAUGE CHECKING

Some 10,000 gauges of various types are in use throughout the VDF Hamburg factory, and great care is taken to ensure that they are maintained in good condition, and are within the prescribed limits when issued for use. Many of the gauges are made by the company, including, for example, solid-type forged-steel, "go" and "not go" snap gauges, which are used in large numbers. The methods employed for checking these gauges, each time they are returned to the stores after use, are of interest, and afford an indication of the thoroughness of the company's approach to the problem of maintaining high quality in the machine tools which they build.

Each snap gauge is provided with a wooden holder, as may be seen at *A* in Fig. 10, whereon is marked the nominal size, and the class of fit, for example h.6. The holder is painted a distinctive colour as a further indication of the class of fit, and the gauge is issued to the operator in the holder. Immediately the gauge is returned to stores after use, the holder is placed face downwards in the appropriate store rack position, and the gauge is passed through a hatch to an adjacent inspection room, for routine checking. This operation is readily carried out with the aid of the drum unit seen in Fig. 11, which carries master rings for gauges of various sizes from 20 to 100 mm., and for the different classes of fit. These rings are held on mandrels by means of end washers and screws, each mandrel carrying rings of different

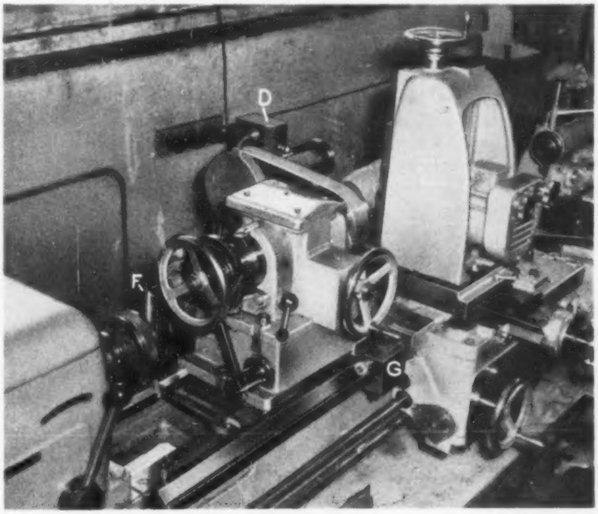


Fig. 9. A View, from the Headstock End, of the Lathe which has been Specially Equipped for Milling the Cam Tracks on Selector Plates

Fig. 10. Method of Using Round Gauging Plugs in Conjunction with a Standard Gauge Block for Determining the Exact Size of a Snap Gauge

nominal diameters, but of the same class of fit. For each gauge size, a single "not go" ring is provided on the left-hand side of the mandrel, for checking the "not go" end of the snap gauge, while on the right, combined "go" and "not go" master rings are provided for checking the "go" end of the gauge. The drum is mounted in trunnion bearings, and can readily be turned by hand, after a spring-loaded, pedal-operated brake has been released. When a gauge has been checked and accepted it is returned to the stores, attached to its holder by adhesive paper tape, and the date and result of the inspection are entered on a record card.

If it is required to ascertain, very accurately, the actual size of a snap gauge, standard Zeiss slip gauges are used in conjunction with the set of round plugs of hardened steel, seen at *B* in Fig. 10, which were supplied by Dr. Ing. A. Pampell, Hamburg-Wandsbeck. The nominal size of these plugs is 2 mm., and the diameter step is 0·001 mm. (0·00004 in.). The set is divided into plus and minus groups, the "plus" plugs being fitted with white plastic handles, and the "minus" plugs with black handles. To check a snap gauge, as indicated at *C*, the appropriate size of standard slip gauge is placed in a bench holder, and an anvil block, incorporated in the holder, is moved into contact with the right-hand end. The anvil of the snap gauge is then held against the outer face of the block, as shown, and the round plugs are inserted between the opposite anvil and the left-hand end of the slip gauge. The use of these round plugs, as will be appreciated, enables any uneven wear of the gauge being checked to be readily detected. An indexing drum-type chart *D* shows the allowable wear on gauges of various sizes and classes of fit, according to DIN. standard 7162.

Gauges with tungsten carbide anvils are employed in some instances, where justified, and in this connection attention is drawn to the GIHA snap gauges of patented design, introduced by Hahn & Kolb, Stuttgart, for which a number of important advantages are claimed. These gauges are available in sizes from 3 to 100 mm. (⅛ to 4 in.), and in double-ended and single-ended forms. An example of the latter type is shown in Fig 12. Developed originally by Siemens Schuckert, Munich, for their own use, the gauges, it is stated, have been employed with success by a number of

Fig. 11. The Various Sizes of Master Plugs Used for Checking Snap Gauges are Conveniently Mounted on an Indexing Drum

other important firms during the past two years.

The frame of the gauge shown in Fig. 12 is of a moulded ceramic material, which was originally adopted to minimize the effect on gauge size of temperature variations from the heat of the hand, or other causes. To provide more robust gauges, however, better suited to workshop conditions, the frames are now made of cast steel.

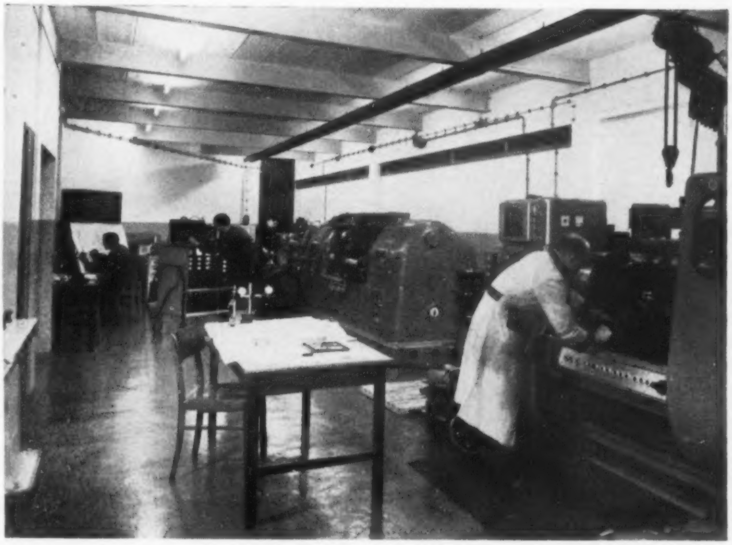


Fig. 13. The New Test Room which is Fully Equipped for Investigations of Operating Efficiency

The three anvil members *A*, *B*, and *C*, which are of U-shape and straddle the ends of the frame, are of steel, and have brazed-on tungsten-carbide faces. Holes, as at *D*, are provided in the frame and the anvil members, and the latter are held securely in position by means of a cold-setting resin, which is poured into the holes and allowed to cool and harden. With this arrangement, the anvil faces can be finish-lapped before the anvils are assembled. The latter operation is very simply carried out by first securing the common anvil *A*, and then positioning the "go" anvil *B*, and the "not go" anvil *C*, by means of slip gauges, and pouring in the resin. Gauges of the exact sizes required, and with accurately parallel anvil faces, can thus be very economically produced, and if it is required to alter the size, a gauge can readily be re-set after melting out the resin at a temperature of about 90 deg. C.

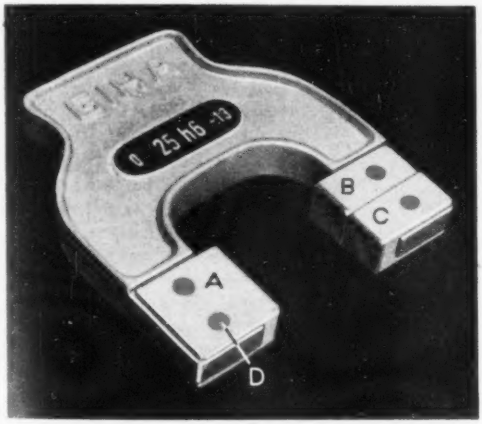


Fig. 12. A GIHA "Go" and "Not go" Snap Gauge with Tungsten Carbide Anvil Faces. The Anvil Members are Held in the Frame by a Cold-setting Resin

NEW LATHE TESTING FACILITIES

The company has recently centralized facilities for the development and testing of new and improved designs of lathes in a separate department which is fully equipped for carrying out detailed investigations on cutting performance, accuracy, handling capabilities, and other factors affecting operating efficiency. A view of this new test room is given in Fig. 13, and on the right, in the foreground, is seen one of the Polycop range of hydraulic production copying lathes, introduced at the 1957 Hanover exhibition. In the centre is a Monocop hydraulic copying lathe, and, in the background, a VDF type S500 Unicop lathe.

PRODUCTION OF PEDAL CYCLES in this country during the first nine months of 1957 averaged 219,000 per month. For comparison, the monthly average for the whole year 1956 was 239,000.

Rocket Launching Tube Produced by Impact Extrusion

Considerable difficulty was experienced by Chance Vought Aircraft, Inc., Dallas, Texas, U.S.A., in producing a satisfactory launching tube for a 2·75-in. rocket. This tube was required for installation in the Chance Vought F8U-1 fighter aircraft, and it was necessary to employ a closed-breech forward-vented arrangement. After various manufacturing methods had been tried, including the application of chemical milling for reducing the tube wall thickness, so as to enable the weight to be kept within the specified limit, the problem was referred to the Hunter Douglas Aluminium Corporation, Riverside, California.

Despite the special problems involved, this company rapidly developed a technique for producing the tubes by impact extrusion. Fig. 1 shows a tube made in this manner, and Fig. 2 is a close-up view of the breech end, cut away to show the external and internal ribs. The external rib is subsequently machined to a dovetail form and the tubes are joined together in pairs. Preliminary tests showed that the tube could be forward impact extruded, cold, from a prepared billet of 2014-T6 aluminium alloy. The overall length is 8 ft. and the diameter approximately 3 in., and it was found that the following dimensional limits could be observed: internal diameter of the three ribs (guide rails), ±0·010 in.; wall thickness, 0·046 ±0·004 in.; bow, 0·06 in., total indicator reading; and twist, 0·10 in. over the full length. After extrusion, each tube is sized to obtain final diameter and to correct bowing resulting from the operation or subsequent heat treatment.

Fig. 1. Rocket Launching Tube, with Internal and External Ribs, Produced by Impact Extrusion. The Overall Length is 8 ft.

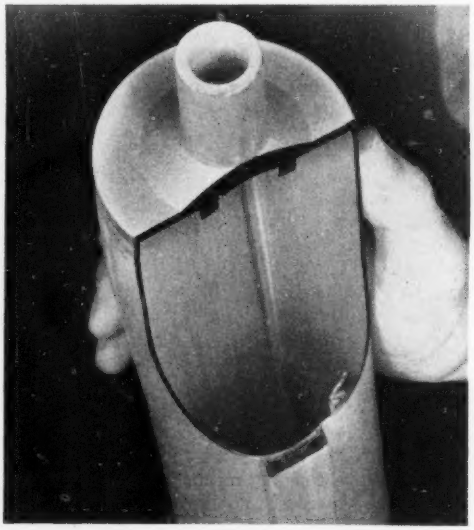


Fig. 2. Breech End of Extruded Rocket Tube, Cut Away to Show the Internal Form These Tubes are Tested at 1,450 lb. per sq. in.

It is stated that the unsymmetrical form of the tube necessitated a special approach to die and punch design, and difficulties had also to be overcome in connection with the sizing operation. The tensile strength of the extruded tubes is stated to be very satisfactory, and they are tested at 1,450 lb. per sq. in.

Quantity Production of Motor Car Bumpers

By C. STARZMAN*

One of the leading suppliers of motor car bumpers in the U.S.A. is Electric Auto-Lite Co., Sharonville, Ohio, and some of the methods employed by this company are here described.

High-tensile steel sheet from 0·093 to 0·120 in. thick, is employed, normally of a width sufficient for two blanks. Strains and waviness in the material are removed by passing it through a roller-type levelling machine. Sheets are then stencilled with the customer's part number, prior to flat polishing.

A Hill Acme machine, 100 ft. long with 16 stations, provides for flat-polishing. There is a coated abrasive belt at each station, and the grit sizes, starting at 80, become progressively finer, so that the sheet is polished to a surface finish of 7 micro-inches or less. Rollers at the various stations ensure that the abrasive belts are applied to the work with the required pressure, and the surface speed of the sheet is about 50 ft. per min. The line is divided into a roughing section and a finishing section. After leaving the roughing section, the sheet is cooled with water and inspected as it enters the finishing section.

In Fig. 1, a sheet may be seen in the foreground emerging from the last flat-polishing station. When it has run out fully on to the roller table, the sheet is shifted automatically to another roller table, seen in the background. From this table, the sheet, moving to the left, enters a phosphatizing and soap-coating line.

Periodically, a flat-polished sheet is brought to a Profilometer, shown in Fig. 2, on which the quality of the surface finish is checked.

The large duct behind the instrument is part of a Roto-Clone hydrostatic precipitation system which handles the exhaust from the flat-polishing stations. Air is washed before being discharged outside the plant, and sludge is sucked out and conveyed to a hopper.

Phosphatizing and soap-coating involves a 6-stage treatment. The line, installed by Ransohoff, handles the sheets at a speed slightly greater than that of the flat-polishing section, to ensure clearance.

Sheets are supported and advanced over the tanks for the various stages on discs grouped on rotating shafts. In this way, the bottom as well as the top of the sheet can be treated. After leaving each tank, the sheet travels through a set of pinch rolls. The first two stages provide for hot spray-cleaning and a hot-water rinsing. A standard phosphatizing solution is applied at the third stage, followed by another hot-water rinse.

At the fifth stage, the soap-coating, which serves primarily as a lubricant, is applied by spray. To

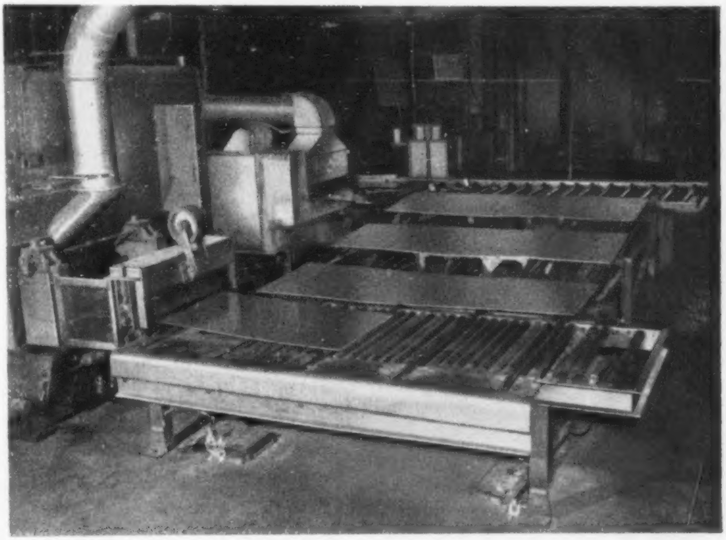


Fig. 1. As a Sheet Leaves the Flat-polished Line it is Shifted to a Parallel Line, where, Moving in the Opposite Direction, it is Phosphatized and Soap-coated

* Electric Auto-Lite Co., U.S.A.

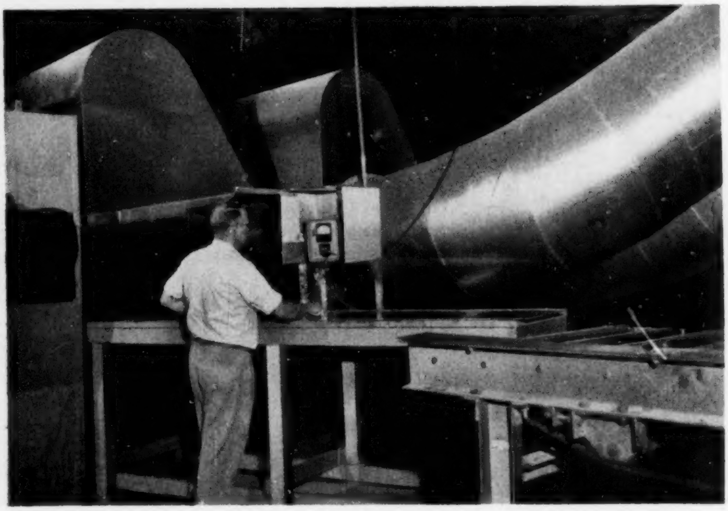


Fig. 2. Periodically, One of the Sheets Leaving the Flat-polishing Line is Brought to this Inspection Station and the Surface Finish is Checked

ensure a uniform thickness of coating, the sheet passes between two air "knives" which blow off excess soap. A steam dryer and blower are provided at the end of the line.

Now fully prepared, the sheet is brought to the press area. Blanks are produced on the first press, and drawn to the required bumper form on the second. A close-up view of the front of the 700-ton Lake Erie drawing press is given in Fig. 3. Blanks are transported by fork truck from the first press, and are deposited on the chain table seen in the foreground. The chains are moved intermittently to advance the stacks of blanks to the loading position.

After the drawing operation, press-line procedure varies somewhat, depending on the design of the bumper. As a rule, trimming, flanging, re-striking, and piercing are required. Fig. 4, for example, is a rear view of a 500-ton Clearing press, equipped with two tools for successively trimming-off excess metal and piercing bracket-bolt holes. (Some bumpers are not pierced, but have mounting brackets welded to the inside. Such bumpers are shunted by monorail to another building, where welding can be carried out in an atmosphere free from contamination.)

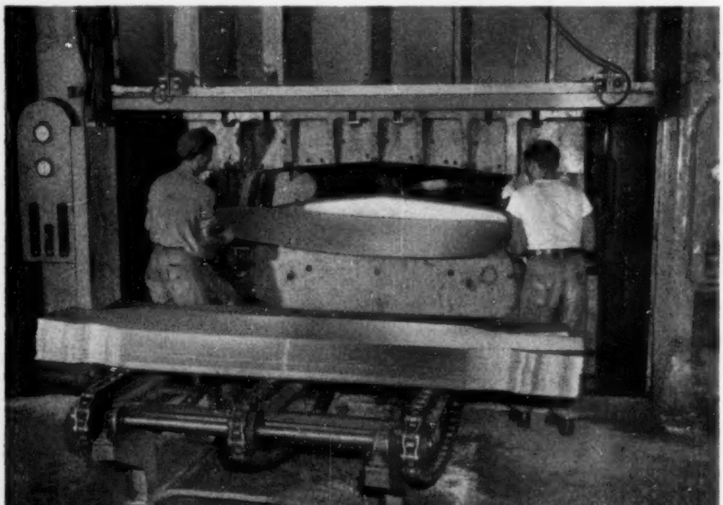


Fig. 3. The 700-ton Lake Erie Press Employed for Drawing Bumpers

Next, the work is contour-polished, where necessary. Because of the shape, three polishing stages may be required; namely, end, rotary, and straight-line. For end-polishing, the bumpers travel front-forward between two 8-station rows of abrasive polishing wheels. Each wheel covers a particular portion of the end contour.

Rotary-polishing serves to finish the top flanges of the bumper. Here the work is

handled on a continuously rotating "merry-go-round" as seen in Fig. 5. In making the circuit, each bumper passes under eight wheels, each of which polishes a particular portion of the flanges. During the final, straight-line polishing, the top and front of the bumper are finished. At this stage, the work is carried on a pallet, and is moved endwise with the front surface uppermost. The pallets advance along one side of a long rectangular table, passing under eight polishing wheels. Upon reaching the end of the table, each pallet moves over a circular platen which shifts it to the other side of the table. The pallet then moves in the opposite direction, and the bumpers pass under a second line of eight wheels.

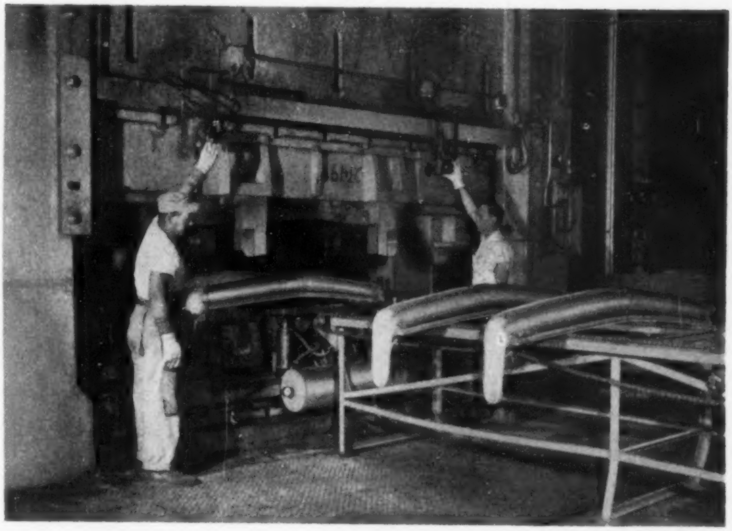


Fig. 4. Two Tools on this Clearing Press Successively Trim and Pierce the Bumpers. The Tank in Front of the Bolster Supplies Air to Lift-out Cylinders in the Dies

All polishing wheels are made and maintained by a special department. They are produced from sisal, emery of various grain sizes, and glue. Each wheel is supported by an adjustable stand and is individually motor-driven. Consequently, the polishing lines can be readily adapted to suit design changes.

From the polishing area, bumpers pass to one of two automatic cleaning and nickel-plating lines, with a cycle time of approximately 60 min. Bumpers are stacked 4-high on racks, which convey them over a series of processing tanks. The racks are advanced in steps and all descend together, to immerse the bumpers in the various processing solutions for a predetermined period.

A view of the line installed by Hanson-Van Winkle-Munning is given in Fig. 6. The first two tanks provide for soak-cleaning and are held

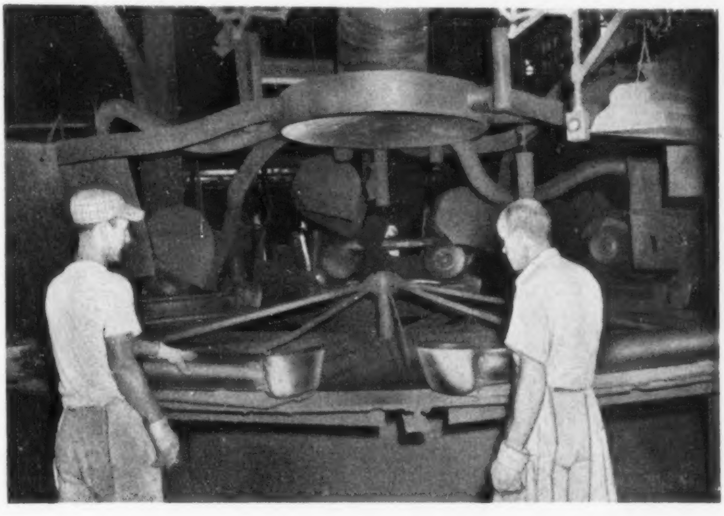


Fig. 5. The Polishing Wheels Engage the Flanges of the Bumpers as they are Carried Round on this Machine

Fig. 6. The Leading Rack of Bumpers has Just Emerged from the Nickel-strike Tank

at a temperature of 200 to 205 deg. F., and the third and fourth tanks, also at 200 to 205 deg. F., contain, respectively, a wetting agent and an electrocleaning solution. For this latter stage, the bumpers are the anodes, and the cathodes are steel bars. Following a warm-water rinse and spray in the fifth tank, the bumpers are electro-acid etched in the sixth tank. At this stage, sheet lead cathodes are employed, and the bumpers again form the anodes. A sulphuric acid solution cleans and activates the work surface.

A cold-water rinse follows, and in the next tank (seen directly beneath the leading rack in Fig. 6), the bumpers receive a nickel strike. This thin deposit prevents oxidation and ensures good adherence of the heavier nickel coating applied later. The strike solution has a high chloride content and is held at a temperature of 125 to 130 deg. F. Here, bars of nickel form the anodes, and the bumpers are the cathodes. Any loose particles of nickel left on the bumpers are removed by a cold-water reclaim rinse in the seventh tank.

At this point, automatic movement of the bumper rack ceases, and it is transported by a manually-operated crane through the remainder of the cycle. The next two tanks serve for semi-bright plating. A 0·0015-in. layer of nickel is deposited, of which 80 per cent is semi-bright, and 20 per cent bright. In both tanks bars of nickel form the anodes, and the bumpers are the cathodes.

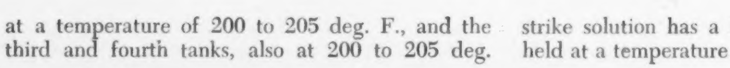


Fig. 7. For Straight-line Buffing, the Bumpers Move on Pallets Along One Side of the Table and Return Along the Opposite Side

The semi-bright plating serves to give good physical properties, and the bright plating reduces the amount of buffing subsequently required. A 10,000-amp. generator is installed adjacent to each tank in the line in which an electro-chemical action takes place. After being bright plated, the bumpers enter a reclaim rinse tank, and, finally, a hot-water rinse and spray tank.

Buffing follows, the equipment and procedure being similar to those employed for contour-polishing. In addition, final "colour" buffing eliminates any laps left by the previous stages. The buffing wheels are made from scrap rags, sewn in spirals.

A view showing part of the straight-line buffing installation is given in Fig. 7. In the foreground of the illustration may be seen the circular platen which shifts the pallets from one side of the table to the other.

The exhaust ducts seen above the various buffing stations are part of an elaborate network which covers the entire buffing and contour-polishing areas. These ducts lead to a 10-unit cyclone system outside the building.

Finally, the bumpers are chrome-plated on one of two duplicate lines. In the first tank in the line, the work is immersed in an electro-cleaner at a temperature of 200 deg. F. Here, the bumpers are the cathodes, and steel bars are employed for anodes. The second tank provides for water rinse and spray, and in the third the work is sulphuric-acid-etched, so that the nickel surface is activated to accept the chromium. Sheets of lead serve as anodes at this stage.

After another rinse and spray, the bumpers enter the chromium-plating solution for a period of about 3 min., during which the required 0·00001-in. is deposited.

Next, the bumpers receive a reclaim rinse. The rinse water flows continuously through an ion exchanger in which it is purified. Evaporators boil down the rinse solution and return it to the plating tank. The cycle ends with the bumpers receiving a final hot-water rinse. •

Robbins Assembling Machine for Automatic-transmission Gear Carriers

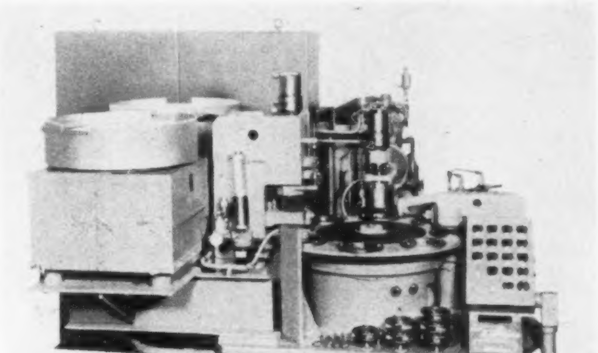
A rotary table machine, as shown in the figure, has been built by the Omer E. Robbins Co., Detroit, Mich., U.S.A., for assembling and checking operations on carriers for automatic-transmission gears. At a previous operation, four pinions, with needle bearings and spacers, are placed in each carrier, and are retained temporarily by dummy pins.

The assemblies are loaded into the machine by hand, and at the first working station, pins for retaining the parts permanently are fed from two vibratory hoppers, through a shuttle arrangement, and are pressed into the holes occupied by the temporary pins, the latter being thus ejected.

At the next working station, the tightness of the fit is checked by the application of a predetermined load, and if any pin does not withstand this load, an electrical circuit is operated, with the result that the assembly is rejected at the next position. Acceptable units pass this station and the pins are finally staked at the ends.

Operations at the various stations are performed hydraulically and the equipment is interlocked electrically. At 100 per cent efficiency, the machine handles 720 parts per hour.

The makers are represented in this country by Gaston E. Marbaix, Ltd., Devonshire House, Vicarage Crescent, London, S.W.11.



Robbins Rotary Table Machine for Assembling and Checking Operations on Carriers for Automatic-transmission Gears

Grinding Chain Rivets to Close Limits

Products of Aktiebolaget C. E. Johansson, Eskilstuna, Sweden, include cycle-chains, and in the department devoted to this work, a Malcus type MC-4 centreless machine is employed for grinding the rivets to close tolerances on diameter, at a high rate of through-put. Initially, the rivets are 4·15 mm. (0·163 in.) diameter, and 11 mm. (0·433 in.) long, and they are ground on this machine to 3·974 mm. (0·157 in.) diameter, within limits of ±0·002 mm. (±0·00008 in.) and to a high standard of surface-finish. The machine, which is shown in Fig. 1, is arranged for hopper feed, and is provided with CEJ Deltameter gauging equipment. Some 36,000 components are ground per hour.

Fig. 1. Cycle-chain Rivets are Centreless Ground to Close Tolerances at the Rate of 36,000 per hour on this Hopper-fed, Malcus Type MC-4 Machine

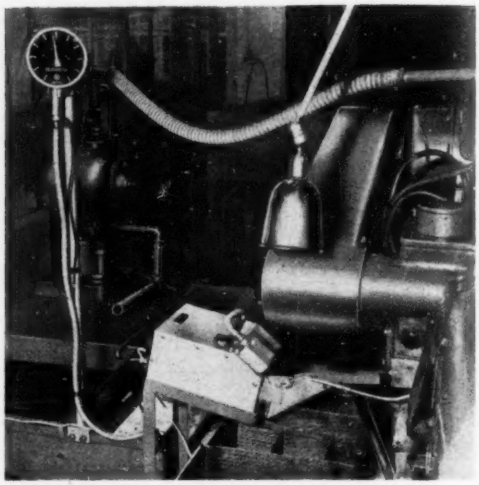


Fig. 2. A Rear View of the Machine, Showing the Deltameter Automatic Gauging Equipment

From the hopper, the components are fed through a tube on to a carbide-faced rest between the wheels. Mounted above the work-rest, in order to prevent "bounce," there is a blade-type steady, and on the exit side, the ground work passes into another tube, which delivers it to the Deltameter gauging equipment shown in Fig. 2 and 3.

In the close-up view, Fig. 3, are seen the delivery-tube and the gauging-head *A*. The latter is of the mechanical-contact type, and has a pair of carbide-faced jaws. Immediately below the jaws at *B*, there is a feed-arm of the oscillating-blade type, to which one component is delivered each time the blade is at the bottom of its stroke. When the blade moves upwards, it inserts the component between the gauging jaws, and a size-indication is provided by the dial-type instrument seen towards the left in Fig. 2. When the blade again descends, the component remains in the jaws, and is automatically ejected when the next piece is raised between them. The ejected component then falls into a bin.

As the blade oscillates at 60 strokes

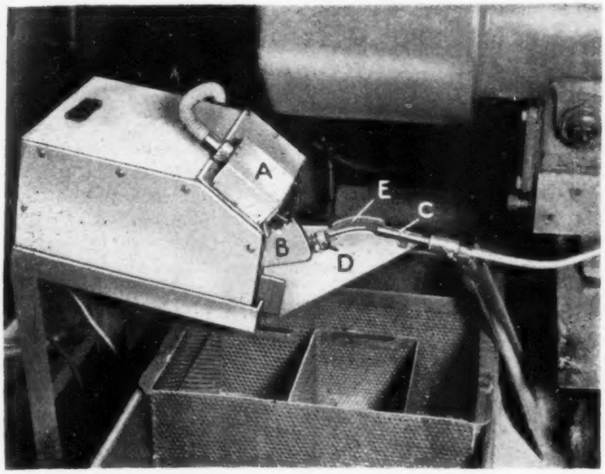


Fig. 3. Close-up View Showing the Gauging Head, and the Automatic Feed Arrangement

per min. and the rate of through-put of components is 600 pieces per min., only a proportion of the rivets is checked. An "overspill" device is therefore incorporated in the feed system, which operates in the following manner. At the end of the delivery tube *C*, Fig. 3, the components emerge on to a semi-circular guide-channel, which is curved in the vertical plane, and at the lower end of this channel there is a guide-nozzle *D*. This nozzle ensures that each component, in turn, is delivered correctly on to the blade, and it is inclined downwards, to form a continuation of the guide-channel. The blade is sector-shaped, and so long as it is raised, the end of the nozzle is closed by the edge.

With "over-feed" conditions, the components are delivered into the open guide-channel faster than they can be removed by the oscillating blade. An axial pressure is therefore built-up, between the components emerging from the end of the delivery-tube, and that held against the curved edge of the blade. If the guide-channel was straight, the pieces would tend to remain co-axial, and the through-feed would be interrupted. Owing to the curvature of the channel, however, the intermediate components in the open section are forced upwards, so that they topple out, and fall into a bin. This action is assisted by the small curved deflector-plate *E*, and continues until the blade descends to receive the next component in the nozzle. Any desired rate of through-feed may thus be employed, without the need for adjusting the gauging equipment.

The indicating instrument seen in Fig. 2 has a measuring range of 0·01 mm. (0·0004 in.) and a scale with widely-spaced graduations of 0·001 mm. (0·00004 in.) so that estimations to a quarter of this amount can readily be made. It is equipped with adjustable electric contacts which are set to close at the limits of the tolerance range, and, if required, these contacts may be employed for automatic feed-back control of the machine. In this instance, however, they serve to illuminate signal lamps when the tolerance-range is exceeded. For the set-up described, a soluble-oil coolant is employed, and wheel-dressing is carried out twice per 8-hour working day.

Output of Man-made Diamonds

Man-made industrial diamonds, identical with those made by nature, are to be produced in substantial quantities by the Metallurgical Products Department of the General Electric Company, Detroit, Mich., U.S.A. More than 100,000 carats of such diamonds have already been produced by a pilot-plant. Successful pilot-plant production has been achieved some two years after the discovery of a reproducible laboratory technique for making diamonds, and 2½-million dollars have been invested by the company in the diamond-production project.

Many industrial firms have been evaluating man-made diamonds for several months, and it is estimated that considerable quantities are now in use in industry. At present, the cost of man-made diamonds is about 40 per cent more than for natural bort, but it is considered that increasing demand will result in greater output and improved processing, which will lead to a reduction in the price of the artificial product.

At present, artificial diamonds range in size from 60 to 600 mesh. Although these sizes are suitable for more than two-thirds of the existing industrial abrasive applications, methods of making larger diamonds are being sought. Specially-equipped presses are employed for diamond manufacture in order that sustained pressures of 2,400,000 lb. per sq. in. and temperatures of 5,000 deg. F. can be maintained.

Artificial diamonds have been made into resinoid and vitrified bonded abrasive wheels.

Interesting Set-ups on Tarex Automatics

Three machines were demonstrated on the stand of Tarex, S.A., Geneva [Tarex (England), Ltd., 22 Buckingham Gate, London, S.W.1], at the recent European Machine Tool Exhibition, Hanover, and the set-ups, also special features of the machines, are here described. A TAR-H/MP chucking machine was tooled, as shown in Fig. 1, for operations on a screwed flange which was turned from an iron casting. The machine is fitted with an 8-station turret, and with tooling on the rear horizontal slide and the rear inclined slide, also with a special Duplomatic hydraulic copying attachment. This attachment is carried on the front slide, as seen on the left in Fig. 1. The tooling equipment also includes, at the upper left, the maker's thread-chasing attachment, which is lead-screw controlled. A sectional view of the component, with some of the principal dimensions, is given in Fig. 2, and it will be noted that the internal form is somewhat complicated. The castings are loaded by hand into the air-operated 3-jaw chuck, and are located axially, and supported, by pins on the chuck face. A tool layout diagram is shown in Fig. 3, where one of the chuck jaws and one of the pins are indicated.

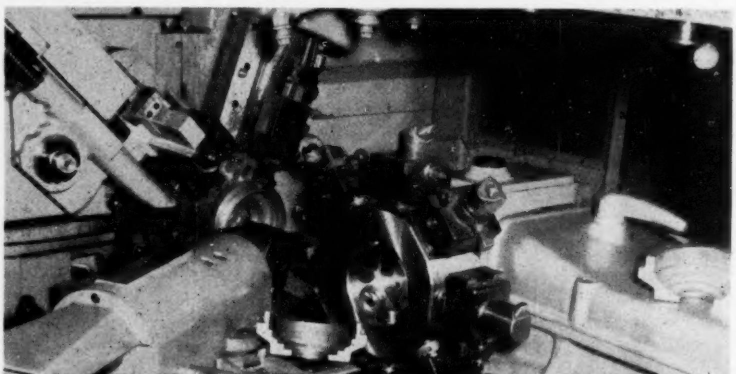


Fig. 1. Close-up View of a Set-up on a Tarex TAR-H/MP Automatic Fitted with a Duplomatic Hydraulic Copying Attachment whereby the Complicated Internal Form is Rough Machined

For the first machining stage, tools in the front and rear slides are applied simultaneously. The rear slide is arranged for transverse movements only, and it carries three tools which are fed straight in to machine two faces and to chamfer one edge of the casting. At the same time, the front slide, which can be traversed both longitudinally and transversely, is fed parallel to the spindle axis until the stylus of the copying attachment comes into contact with the template. The stylus projects from the under-side of the attachment housing at the outer end, and the template is mounted in a fixed bracket beneath. Under the control of the template, the interior of the casting is machined to the approximate form required. At this stage, the spindle rotates clockwise, as viewed from the front, at a speed of 263 r.p.m., and the tools on the front slide are inverted. Towards the end of the copying cut, two additional tools on the front slide come into operation to turn the 110- and 125-mm. diameters on the outside of the casting. For facing, the feed is 0·08 mm., and for copy-boring and plain turning, 0·20 mm. per rev.

When this stage has been completed, the copying attachment is withdrawn, and tools at the first turret station are employed to finish an internal face and form the adjacent undercut. This tool is advanced by the turret to a fixed position, and is then fed sideways by a pusher on the rear horizontal slide, which is again advanced at this stage. At the same time, two tools carried on the rear inclined slide are fed down to finish face and chamfer the shoulder adjacent to the thread diameter, form a undercut, and

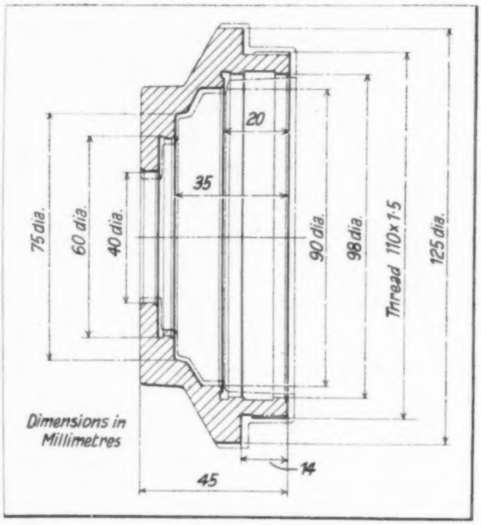


Fig. 2. Sectional View of the Screwed Flange which is Machined from an Iron Casting with the Set-up shown in Fig. 1. The Outline of the Casting is Shown by the Chain-dotted Lines

chamfer the front corner of the casting. The thread-chasing attachment, mounted above and in front of the spindle at an angle of about 45 deg., is also brought into operation at this stage to cut the 110- by 1·5-mm. thread, which is completed in a total of 20 passes. For these operations, the same spindle speed is employed.

Tools at the remaining turret stations are subsequently applied to finish the more important of the internal diameters and faces, the pusher on the rear slide being employed as required. After the third stage, for which the spindle speed is again 263 r.p.m., with right-hand rotation, the speed is increased to 619 r.p.m., and the direction of rotation reversed, except for stage eight, at which the 98-mm. internal diameter is finished at 263 r.p.m. Feed rates for the last five turret station tools range from 0·04 to 0·18 mm. per rev. The cycle time for this component is 4½ min.

AUTOMATIC WITH CONSTANT CUTTING SPEED

On the TAR-H 90/75 electronic machine, a general view of which is given in Fig. 4, a Ward-Leonard set is provided for the spindle drive, and the speed can be steplessly varied within a ratio of 20 : 1, whereas the overall ratio for the standard gear-driven spindle is 10 : 1. The spindle speeds are controlled by potentiometers housed in the cabinet at the extreme left in Fig. 4, and they are set for the various turret positions by means of six or eight knobs—depending on the number of positions—on the control panel. A rotary switch, turned by the indexing motions of the turret, selects the required spindle speeds for the operations to be performed by connecting the potentiometers to the Ward-Leonard set, in succession. In addition, for facing operations carried out with cross-slide tools, a potentiometer housed in the machine can be operated by a cam on the feed camshaft to vary the spindle speed as the tool is traversed, so that the optimum cutting speed is maintained and the cutting time is kept to a minimum.

A sectional view of an ammunition cap produced with the demonstration set-up is shown in

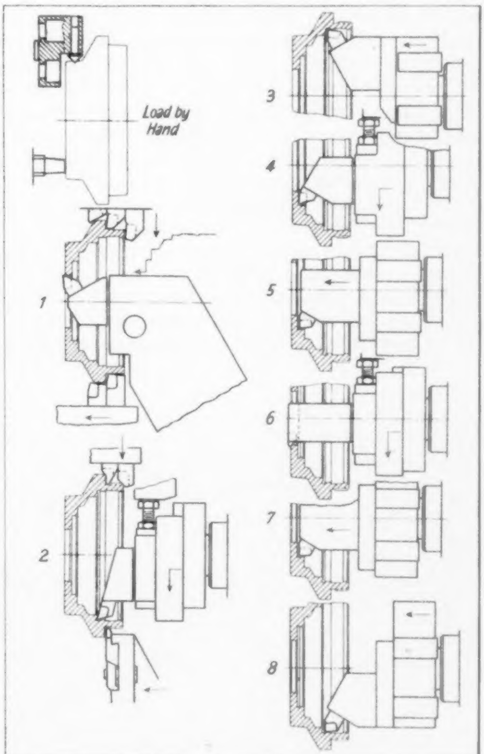


Fig. 3. Tool Layout for Machining the Screwed Flange on a Tarex Automatic Fitted with a Hydraulic Copying Attachment. After the Internal Form has been Rough Copy-turned, Certain Diameters and Faces are Finished with Turret Tools

Fig. 5. This part is made from 75-mm. diameter brass bar, which is held in a collet chuck. A tool layout diagram is given in Fig. 6. The bar is fed to a turret stop, and, at the next stage, the flat end is drilled 48-mm. diameter with a turret tool, and the corner is chamfered with a second tool mounted at the same turret station. While drilling is in progress, a tool on the rear slide is fed in to start forming the tapered rear face of the cap, and another tool, on the front inclined slide, assists this operation by removing material on the chuck side of the rear-slide tool. At the same time, a second tool on the inclined slide is applied to face the end of the workpiece.

During the third stage, the feed of the rear slide and the front inclined slide is continued, and a 33-mm. hole is drilled with a spade tool in the turret. The turning operations are carried out at spindle speeds which are varied by the potentiometer on the machine from 850 to 1,500 r.p.m. to maintain a cutting speed of 670 ft. per min. The drilling operation is started at a spindle speed of 1,300 r.p.m. and continues while the speed rises to the maximum value indicated. Further forming is carried out by the tool on the inclined slide during the fourth stage of the cycle, the spindle speed being again increased to a maximum of 1,860 r.p.m. In addition, a 12-mm. diameter hole is drilled with a turret tool. An internal facing operation is performed with a turret-mounted tool actuated by a pusher on the rear cross-slide at the next stage. The tool is fed outwards, and at the end of the facing operation it forms an undercut.

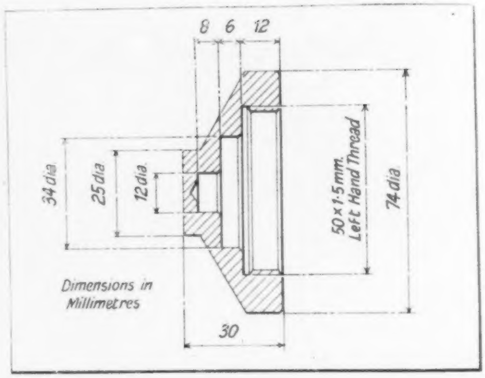


Fig. 5. Sectional View of an Ammunition Cap Produced from Brass Bar Material of 75-mm. Diameter on a Tarex Machine with Steplessly-variable Spindle Speeds, in a Cycle Time of 1 min. 45 sec.

the spindle speed being progressively reduced from 1,860 to 1,260 r.p.m. For all the stages so far discussed, the spindle rotates right-hand, but for tapping the 50- by 1·5-mm. left-hand thread, at stage six, it is reversed, and run at a speed of 132 r.p.m. When this operation has been completed, the direction is again reversed for withdrawing the tap.

After tapping has been completed, a boring tool

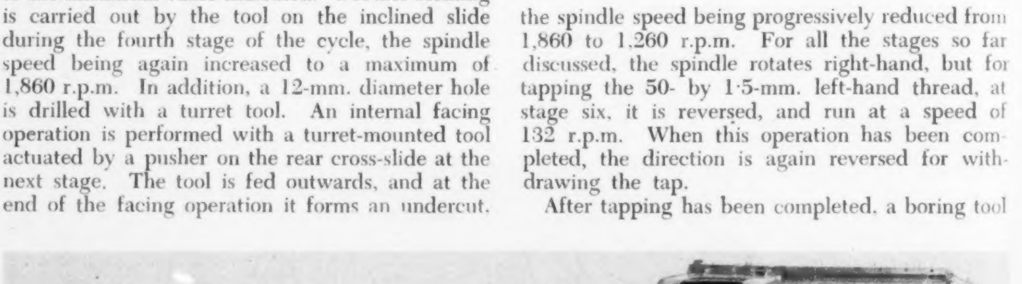


Fig. 4. General View of a Tarex Machine Fitted with a Ward-Leonard Motor-generated Set Whereby the Spindle Speed can be Steplessly Varied to Maintain Constant Cutting Speed

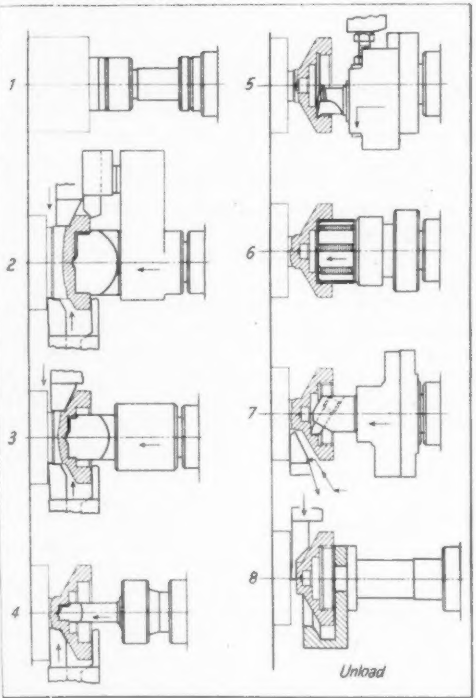


Fig. 6. Tooling Layout for Producing the Ammunition Cap. During the Turning Operations on the Tapered Back Face of the Cap the Spindle Speed is Automatically Varied from 850 to 1,860 r.p.m.

at the next turret station finishes the 34-mm. diameter. At the same time, an inverted tool on the front slide, controlled by a former cam, finish turns the tapered back face of the cap, the spindle speed again being varied from 850 to 1,860 r.p.m. by the built-in potentiometer. This tool also turns the adjacent 25-mm. diameter.

Finally, at the eighth stage, a channel-section holder on the turret is moved into position to receive the component when it is parted off by a tool on the rear inclined slide. The cycle time for this part is 1 min. 45 sec.

A view of the set-up on a TAR-L/42 MPS automatic for machining a cast iron pulley is shown in Fig. 7. The rough castings are loaded into the channels of the magazine chute with the boss on one side facing towards the chuck. On the turret there is a loading cup, with spring fingers to engage and grip the boss. The magazine chute is mounted on two pairs of parallel-motion struts, and it can be moved towards the turret slide by means of an air cylinder, the ram of which is connected to the outer pair of struts. When the magazine is moved in this way, the lower end, to which the pulleys roll by gravity, is aligned with the loading cup on the turret during the rearward movement of the turret slide. At the end of this movement, while the turret dwells, another air cylinder on the inner end of the magazine is operated, through a limit switch and solenoid valve. The ram of this cylinder advances to push the lowest pulley in the magazine into the loading cup and then immediately returns, so that the other pulleys can move down the magazine. Return of

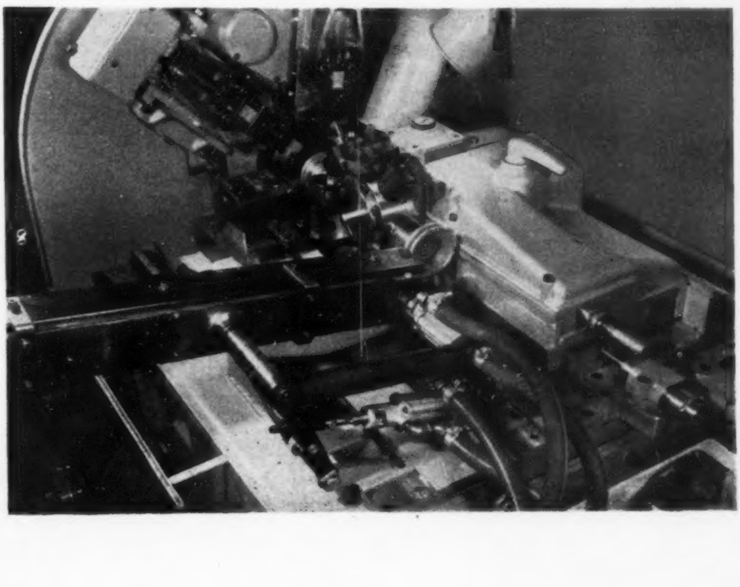


Fig. 7 (below). Set-up on a Tarex TAR-L/42 MPS Machine for Operations on a Cast-iron Pulley. Holders at two of the Turret Stations Provide for Loading and Unloading the Components Automatically

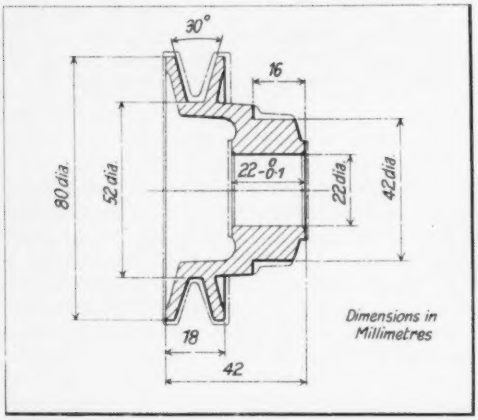


Fig. 8. Sectional View of the Cast-iron Pulley which is machined with the Set-up in Fig. 8, in a Cycle Time of 3 min.

the magazine to the outer position, in which it is shown, completes the loading cycle, and successive indexing motions of the turret carry the casting round until it is aligned with the spindle. An air-operated chuck is employed, which is shown in section in the tool layout diagram, Fig. 9. The outside rim of the loading cup applies pressure to the pulley flange as the component is advanced towards the chuck, with the result that the opposite side of the flange is pushed into contact with a shoulder. Three gripping fingers are then expanded by the action of the chuck draw-bar to grip the inside of the pulley, and the turret slide is withdrawn. Sectional views of the pulley and of the casting—which is indicated by chain-dotted line—are given in Fig. 8, and the first machining stage provides for rough forming the groove with a tool on the rear inclined slide. At the same time, one of the three tools on the front slide is fed longitudinally to turn the outside of the pulley to 80 mm. diameter, and turret tools are applied to centre and face the boss.

The next turret station is equipped with a drill and three turning tools whereby a 20-mm. diameter hole is drilled through the boss, the end face is formed at an angle, the outside of the boss is turned to 42 mm. diameter, and the pulley flange is recessed. Simultaneously, both sides of the flange are faced by tools on the front inclined slide. At the next stage, three turret tools chamfer the corners, and front and rear slide tools are fed in under cam control to face opposite sides of the pulley grooves and to finish the rim peripheries. All these operations are carried out at a spindle speed of 343 r.p.m. For the remaining stages, which are concerned mainly with the boss, the speed is raised to 943 r.p.m. with the same direction of rotation. The boss is semi-finish bored and the outside diameter is finish-turned to 42 mm. at stage five, and a tool at the sixth turret station faces the inner end of the boss, transverse movement being imparted by a pusher on the rear slide. Machining is completed by finish-boring the boss of the workpiece to 22 mm. diameter at the seventh stage.

The component is then unloaded by another cup-shaped holder on the turret. This holder has slotted spring sides which embrace and grip the boss as the turret moves forward. The chuck is then opened to release the pulley, and the turret moves back for the next indexing movement

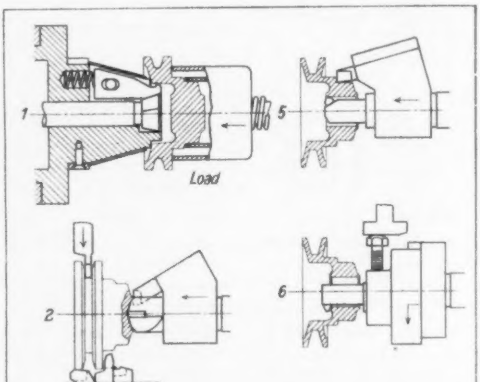


Fig. 9. Tooling Layout for Machining a Cast-iron Pulley. The Sides of the Pulley Groove are Finish-faced at the Fourth Operation by Cam-controlled Tools on the Front and Rear Slides

which completes the cycle. Inside the unloading cup there is an ejector plunger which is held in the retracted position by a light spring. The inner end of this plunger projects through a hole in the drum towards the shaft on which the turret is mounted. On this shaft there is a cam, and as the turret is subsequently indexed, the ejector plunger is pushed outwards so that the pulley falls out of the cup into a chute. This component is machined in a cycle time of 3 min.

Lee Guinness Vapormatic Rheostat for Starting Slip-ring Electric Motors

A rheostat of new design, for the automatic starting of slip-ring electric motors, is being produced by Lee Guinness, Ltd., Newtownards, Northern Ireland, under licence from the French firm of A.I.O.P.-Bérard. Known as the Vapormatic, this rheostat has, it is stated, already gained widespread acceptance on the Continent, where some thousands of units are reported to be in service. In Fig. 1 is shown a line of presses at the Renault factory in Paris, which are fitted with Vapormatic starters, the units being accommodated in frames at the left-hand side.

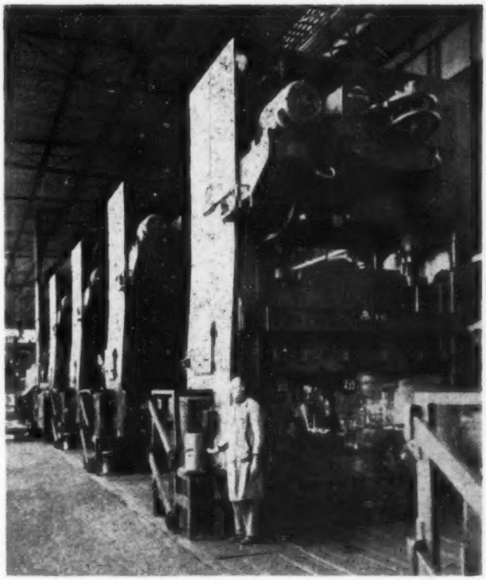


Fig. 1. A Line of Presses at the Renault Factory in Paris, Provided with Vapormatic Starting Equipment. This Equipment is now being Produced Under Licence by Lee Guinness, Ltd.

The principle of operation is based on the large difference between the electrical resistances of a liquid electrolyte and its vapour, the resistance of the latter being some 50 times as great. Designed for connection in the rotor circuit of a motor so as to form the "star" point, the rheostat incorporates a small closed chamber containing liquid electrolyte, in which are mounted current-carrying electrodes. The chamber has a number of small orifices, of critical diameter, in the walls, and is submerged in a much greater volume of electrolyte in a cylindrical tank. Controlled flow of the liquid can thus take place between the inner and outer compartments.

When the stator circuit of the motor is closed by the operation of the starting switch, the very high current which is normally induced in the rotor circuit produces almost instantaneous vaporization of the liquid in the electrode chamber, with the result that electrical resistance is greatly increased. Some of the vapour is expelled through the orifices into the outer compartment, where it condenses into the main volume of the liquid contained therein.

Because of the high resistance, the flow of current to the rotor is decreased. In consequence, the degree of vaporization is reduced, and some of the liquid electrolyte is permitted to return to the electrode chamber. As the motor accelerates and less rotor current is induced, the resistance in the circuit is progressively diminished. Ultimately, when the starting cycle has been completed, the electrode chamber is once more completely filled with liquid, the electrical conductivity of which is sufficient to carry the normal rotor current without any vaporization. When this condition has been reached, the rheostat is automatically switched out of the circuit by a time-controlled magnetic contactor.

In practice, the resistance introduced into the rotor circuit varies in direct proportion to the liquid/vapour ratio in the electrode chamber, and is thus reduced in direct relation to the rotor current. With this starting arrangement, reduction of the resistance is effected steplessly, so that constant torque is applied and smooth acceleration obtained.

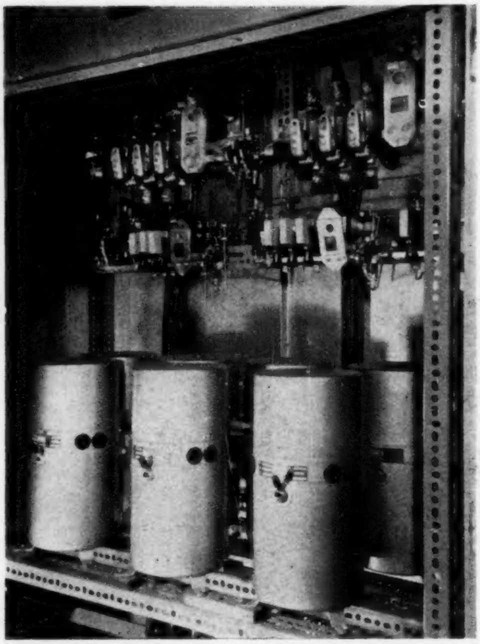


Fig. 2. This Vapormatic Equipment is Provided for Starting a Motor of 250 h.p.

The unit can be used for starting motors up to 40 h.p. over a wide range of conditions from no load to full load. For motors of greater size, several of the units are employed and are connected in parallel. Compared with equipment of conventional design, with "stepped" resistances, the starter is claimed to afford substantial savings as regards initial cost and subsequent maintenance, and in floor space. In Fig. 2 is shown an installation of Vapormatic equipment for starting a 250-h.p. motor.

The multiple rheostats can clearly be seen in the lower part of the illustration.

Under additional manufacturing agreements which have been made with the Swedish firm of A.S.E.A. and the German firm of Voigt & Haeffner, the company propose to introduce a full range of automatic control equipment, and examples will be shown at the forthcoming A.S.E.E. exhibition to be held at Earls Court, London, in March.

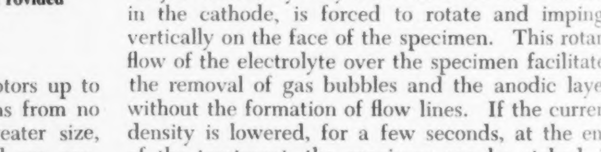
Shandon Electrolytic Polisher

The equipment here shown has been developed by the Shandon Scientific Co., Ltd., 6 Cromwell Place, London, S.W.7, for electropolishing metallic specimens prior to microscopic examination. When such specimens are polished by means of abrasive powders, considerable skill and time are required, and it may be difficult to obtain uniform, consistent and comparable specimens by this method. In addition, the consequent work hardening of the surface may result in micro-hardness readings which are in excess of those for the core of the material.

To overcome these difficulties, the process of electrolytic polishing has been developed, and is claimed to offer the following advantages. Consistently repeatable results in the preparation of specimens can be obtained by relatively unskilled operators, and the part is free from the fine scratches associated with hand-polishing. All deformed surface metal is removed, so that the true structure is exposed, and the time taken to prepare a specimen is considerably less than that required for abrasive polishing.

In operation, the specimen is loaded into the polisher where it serves the function of an anode. An electrically driven pump circulates the electrolyte which, by way of a series of holes drilled in the cathode, is forced to rotate and impinge vertically on the face of the specimen. This rotary flow of the electrolyte over the specimen facilitates the removal of gas bubbles and the anodic layer, without the formation of flow lines. If the current density is lowered, for a few seconds, at the end of the treatment, the specimen can be etched, in order to reveal the grain structure.

This polisher has been developed from equipment originally designed at the Atomic Energy Research Establishment, Harwell.



Shandon Electrolytic Polisher for Preparing Metallic Specimens for Microscopic Examination

New Production Equipment

Jones-Shipman 72-in. Spline Grinder

A. A. Jones & Shipman, Ltd., Narborough Road South, Leicester, have recently introduced the spline grinder shown in Fig.1. A close-up view of the wheel-head and table is given in Fig. 2.

The machine will admit 72 in. between the work-head and tailstock centres, and enables grinding to be carried out over a maximum length of 66½ in. It has a centre height of 7 in., and maximum and minimum distances of 11½ and 3½ in. are obtainable between the work and wheel spindle axes.

Grinding wheels of up to 10 in. diameter can be mounted on the Nitralloy spindle, which runs in lead-bronze bearings. End thrust is taken through a central flange on the spindle by two phosphor-bronze shoes, which can be adjusted for clearance by means of a knob on the housing. The spindle can be adjusted axially in its bearings by movement of the entire thrust bearing assembly, and for fine adjustment there is a separate knob on the housing, and a dial indicator is fitted to facilitate accurate setting. The length of the tapered spindle nose is such that an adapter to take a wide grinding wheel, or a pair of wheels, can be fitted.

The spindle housing, which can be removed as a complete unit, is secured at the front end to the wheel-head casting, and is attached at the rear to an adjustable plate, whereby it may be set accurately parallel with the table guideways. Counter-balancing of the wheel-head is by a number of slotted circular weights which are carried by a hanger bar housed in the column, the latter being bolted to the bed. The wheel-head slides on a guideway member which is bolted to the column, and has a small adjustment for angle, to facilitate setting the spindle for squareness. Vertical adjustment of the wheel-head is effected by worm gearing and a screw, which run in an oil bath, and the fine feed hand-wheel enables settings to be made to an accuracy of 0·0001 in.

Mounted on vee and flat bedways, the table has a maximum stroke of 84 in., and the steplessly-variable traversing speeds available range up to 60 ft. per min. The length of the bedways is such that there is only a very short overhang when the table is in the extreme positions. Fixed "half" guards are provided for the bedways, and there is a central belt-type guard, so that the bed is covered for its entire width. The table is of dovetail form in cross-section for locating the work-head, tailstock and steadies. A wheel-dressing attachment mounted at the left-hand end of the table, has a cross adjustment of 3 in. on each side of the central position.

The design of the tailstock is such that it can be passed beneath the grinding wheel during the

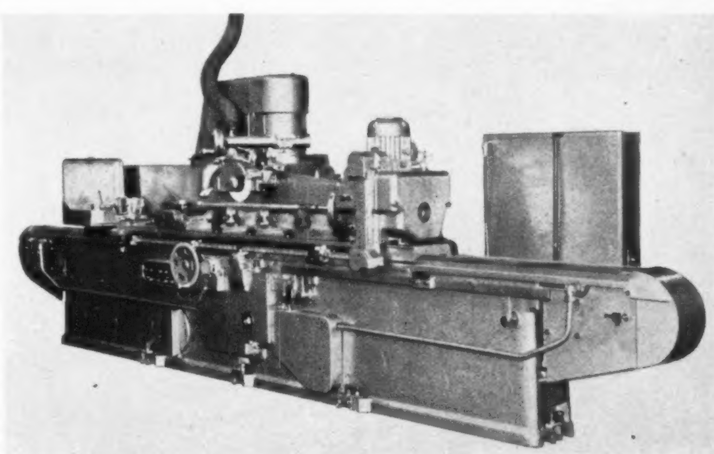


Fig. 1. Jones-Shipman 72-in. Spline Grinder

grinding cycle, and the lever-operated slide which carries the cone centre is mounted on a pivoted platform, whereby small adjustments for height may be made. There is also provision for cross adjustment. Traversing speed of the table is increased by clockwise movement of a conveniently-placed lever, and, when this lever is returned to the central position, and released, it is moved towards the bed by spring action. Anticlockwise movement of the lever, in a gate, then causes the hand traversing mechanism to be engaged. During the last part of the working stroke, in each direction, the table speed is automatically reduced by means of vertical plungers which are mounted at each side of the reversing lever, and are moved downwards by engagement with the inclined lower edges of adjustable stops on the table. In this way, smooth and accurate reversal is obtained consistently.

When the table is to be moved to the extreme right-hand end of its travel to bring the dressing attachment to the working position, the reversing lever is moved away from the bed by hand, so that it is held clear of the left-hand stop. This action also prevents the table speed from being reduced by engagement between the left-hand stop and plunger. The table is then brought to rest, at the end of its travel, by the action between a separate stop and a second vertical plunger at the left-hand side of the reversing lever.

By means of a switch mounted on the control panel at the front of the bed, the machine can be set so that the work is automatically indexed when the grinding wheel is brought clear of the piece at the right-hand end of the table travel. For indexing, a self-contained hydraulic unit is incorporated in the work-head. An indexing disc with notches round its periphery is provided, which, in conjunction with interchangeable masking plates, enables 2, 3, 4, 6, 8, 12, 24 and 48 divisions to be obtained.

Simultaneously with the operation of the reversing lever, when the table is brought to the right-hand end of its working travel, a cam incorporated in the work-head is turned through an angle of 90 deg. by engagement with a striker plate, which is adjustably mounted on a spring-loaded rail at the right-hand end of the bed. As a result, a solenoid-operated valve is de-energized, and the table is caused to dwell while indexing takes place. At the same time, the cam causes a second solenoid valve to be energized, with the result that a spring-loaded safety plunger incorporated in the work-head is brought out of engagement with the index disc, hydraulically. Thereupon, the work-head spindle is rotated by means of a hydraulic motor, and, during this movement, a pawl is raised clear of one notch in the index disc and falls into the next. At this point in the cycle, the hydraulic motor is reversed, so that the face of the second notch in the disc is held in close contact with the pawl. Finally, the safety plunger is engaged with the disc by spring action. This plunger serves only to prevent accidental rotation of the disc in the event of failure of the electric or hydraulic system.

Four interlocking bars are moved into engagement with the cam, in turn, at the beginning of the different stages of the indexing cycle, and each bar is brought clear upon completion of the corresponding stage. When any, or all, of the bars are in the working position, return movement of the cam is prevented. When all the bars have been brought clear, the first solenoid valve is energized, with the result that the table is moved to the left,

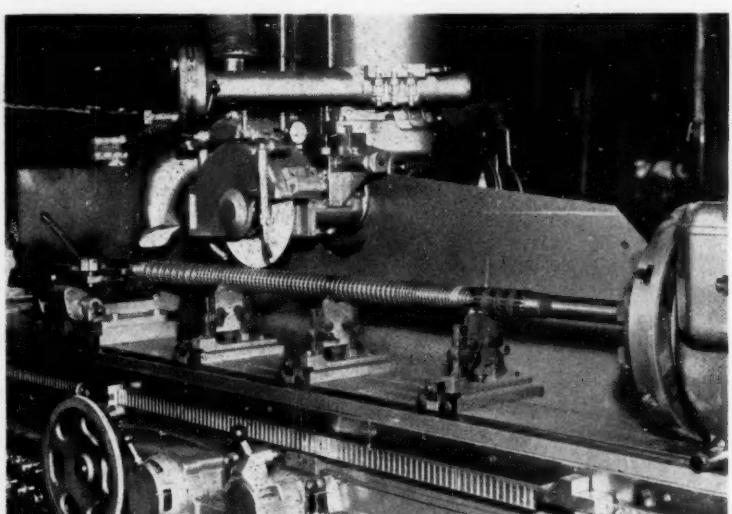


Fig. 2. Close-up View of the Spline Grinder Shown in Fig. 1

under power traverse, to perform the next cutting stroke, and the cam is turned freely in the reverse direction by contact with the striker plate.

In the event of accidental movement of the table under power traverse before indexing has been completed, interference by one or more of the interlocking bars prevents the cam from being rotated by the striker plate. Since the rail which carries this plate is spring-loaded, it is then caused to move lengthwise, and operate a safety valve to stop the table.

When the cam has been turned to the indexing position, and the lever which controls the table speed is set vertically, the work-head spindle can be continuously rotated by depression of a push button. Upon release of the button, the spindle is stopped at an indexing position.

The hydraulic unit for the table drive, and a cabinet which houses the electrical equipment, are mounted on the shop floor at the rear of the machine.

Witzig & Frank Vertical Chucking Automatics

In Fig. 1 is shown an example from the range of vertical chucking automatics built by the German firm of Witzig & Frank, for whom the selling agents in this country are B.P.S. Machinery & Spares, Ltd., 245 Knightsbridge, London, S.W.7.

Designated Adamat 2, this machine has a 3-station indexing table carrying self-centring chucks, the hardened steel jaws of which are fitted with steel gripping pieces of suitable shape to accommodate the workpieces. There are two spindle heads, which can be adjusted independently on the ways of the fabricated steel column, for setting purposes. The machine is here shown set up for performing a drilling operation on the work at one station, and a tapping operation at the second station. Loading and unloading of the workpieces is carried out at the third station. If required, the spindle heads may be employed for performing turning and external screwcutting operations. Alternatively, multi-spindle heads may be fitted.

The heads are driven by separate motors through V-belts, and stepped pulleys. Motors with different operating speeds can be fitted, and the spindle speeds obtainable range from 112 to 2,240 r.p.m. for the drilling and turning head, and from 95 to 750 r.p.m. for the threading head. Gears are incorporated in the drives, which are engaged to obtain the lower spindle speeds in the ranges. Indexing of the table, operation of the chucks, and rapid power traverse and feed of the cutter head spindles, are effected hydraulically, the pump and

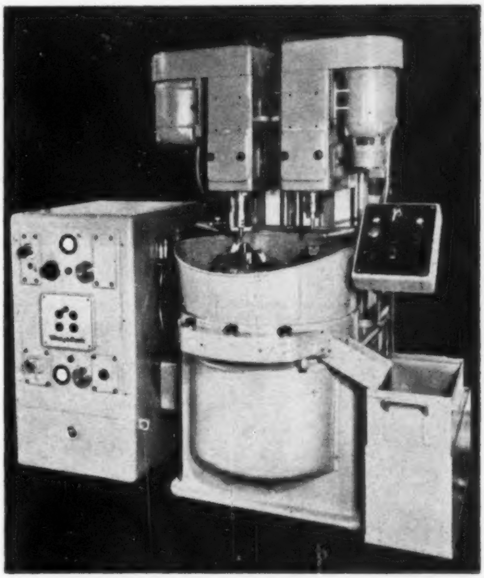


Fig. 1. Witzig & Frank Type Adamat 2 Vertical Chucking Automatic

control equipment being housed in a separate floor-mounted unit at the side of the machine. The steplessly-variable feeds obtainable range from ¾ to 60 in. per min. Maximum strokes of 4 in. for the drilling spindle and 3¼ in. for the tapping spindle are obtainable, and the tapping head can be fitted with interchangeable leadscrews and nuts for controlling thread pitch. The feed and rapid power traverse movements of both spindles can be varied, to suit requirements, by means of limit switches.

When a workpiece has been loaded, the automatic operating cycle is started by depressing, simultaneously, two push buttons at the front of the cast-iron bed, and this arrangement ensures that the operator's hands are clear of the working area. The chuck jaws are then closed, and the table is indexed so that the fresh component is brought to the drilling station, a previously drilled part to the tapping position, and a completed workpiece to the loading station. Next, the chuck which holds the machined parts is automatically opened. Removal of this piece from the chuck, and loading of a fresh component are then carried out while drilling and tapping is being performed on the other parts. In the event of faulty loading of the work, indexing of the table can be prevented, after the chuck has been closed, by depression of a

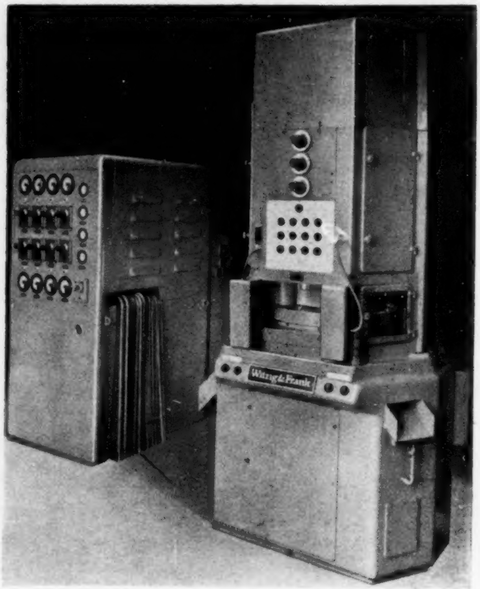


Fig. 2. Witzig & Frank Type ADA.8 Vertical Spindle Automatic

central push button. If required, a photo-electric guard can be fitted, which causes a signal to be transmitted to the control equipment, so that the next cycle will be started automatically, when the operator's hands have been brought clear at the end of the loading operation. The spindle heads, table and chucks can be operated separately, for setting, by conveniently-grouped push buttons, and provision is made for inching.

Machines of similar design with 3, 4, 6 and 8 cutter spindles and 3-, 4-, and 6-station work tables are also available.

The type ADA.8 vertical spindle automatic shown in Fig. 2 incorporates four pairs of cutter heads, and a 6-station indexing table arranged to accommodate 12 workpieces. With this machine, similar operations are performed, simultaneously, on two workpieces at each table station. Three pairs of cutter spindles may be employed for turning and boring operations, and the fourth pair is intended for cutting internal and external screw threads. Loading is carried out by hand, and machined components are automatically discharged at the end of the operating cycle by means of an ejector mechanism.

A photo-electric guard is fitted at the loading station, and can be arranged to start the next working cycle automatically as soon as the operator's hands have been brought clear.

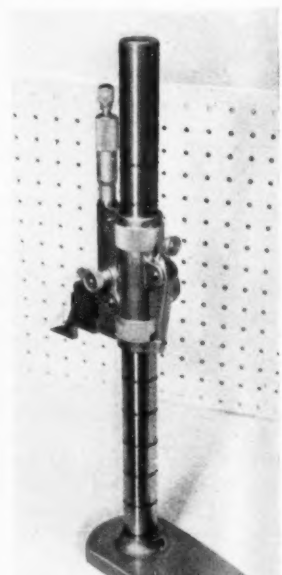
All motions of the machine are effected hydraulically, and the spindle speeds and cutting feeds can be steplessly varied by means of throttle valves. The associated hydraulic pump and control equipment is housed in a separate floor-mounted unit. In the event of any of the cutter spindles being overloaded, the machine is automatically stopped, and the spindles in question are indicated by dial-type instruments and signal lamps.

Altimax Micrometer Height Gauge

Recently introduced by the Sigmax Engineering Co., Coronation Road, High Wycombe, Bucks, the Altimax micrometer height gauge, here shown, is made in five sizes, with measuring ranges of 12, 18, 24, 36 and 48 in.

Settings of the measuring head in increments of 1 in. are obtained by means of a spring-loaded latch which engages with annular grooves in the column. The latter consists of a number of hardened steel sleeves which surround a central pillar, and are chamfered at one end. With this arrangement, the grooves are formed by the abutting plain and chamfered ends of the sleeves. Final settings of the measuring head are made with the built-in micrometer. The measuring head can be turned through a full circle on the column, and when it is set in its lowest position the stepped scribing blade extends below the bottom surface of the hardened steel base.

A. Douglas & Co., Ltd., Lancaster Road, High Wycombe, Bucks, are the distributors for Altimax height gauges.



Altimax Micrometer Height Gauge

Köping Type HKS-2 Hydraulic Copying Lathe

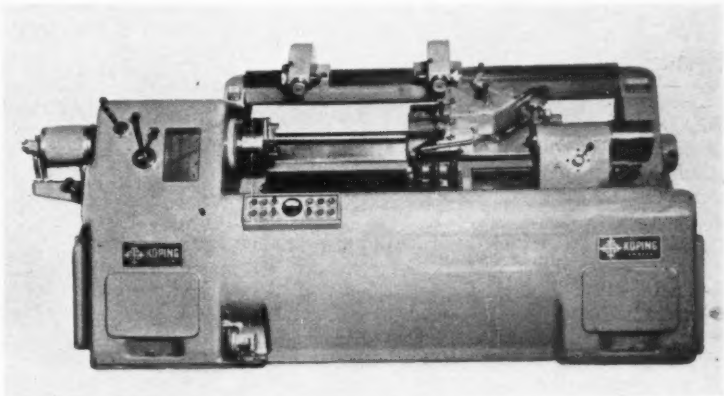
Recently introduced by the Swedish firm of Köping, the type HKS-2 hydraulic copying lathe, here shown, will swing a diameter of 9⅞ in. over the saddle and 15¾ over the bed-ways, and a maximum length of 47¼ in. is admitted between the headock and tailstock centres.

The base is enclosed at the front, and has a clear space at the rear to facilitate the disposal of swarf. Located at the rear of the base, the well-ribbed bed has an inclined guideway for the hydraulically-operated copying slide, which is set at an angle of 45 deg. to the work axis, and has a cross travel of 4¾ in. The cutter slide is adjustable at right angles to the work axis through a distance of $1\frac{3}{16}$ in. Automatic lubrication of the copying slide and the bed-ways is provided by a pump at the rear of the base. A separate guideway, attached at one end to the headstock, and at the other to a projection from the bed, carries a pair of adjustable centres for holding a cylindrical master of the part to be produced. Alternatively, profile shapes can be reproduced on the work from sheet metal templates.

The lathe can be set for automatic re-cycling, and up to four cuts may then be taken on the work at successive passes of the copying slide. A crank at the tailstock end of the bed is employed for selecting the number of cuts to be taken, and the lengths of the feed strokes are pre-set by means of adjustable stops on an indexing bar which extends parallel with the work axis. For rough turning during the first pass, the stylus pin of the copying equipment may be held clear of the template by an adjustable stop on the slide. When the slide has been returned to the tailstock end of the bed upon completion of the first pass, the stylus pin is released, so that it makes contact with the template during the next pass. At the same time, the bar is indexed, to bring the next set of stops to the working position.

A separate inclined bedway is provided for the front tool slide and the air-operated tailstock. The latter has a built-in rotating centre. When the tool slide has been adjusted longitudinally, by hand, it can be secured to the guideway in the required position. In-feed is effected hydraulically, and may be engaged by a push-button, or, automatically, by an adjustable stop. Rapid power traverse towards the work, feed, and rapid return movements are provided for the slide.

Drive to the headstock is transmitted by V-belts from a 20-h.p. motor housed in the base. The spindle speeds can be varied in the ratio of 1·75 to 1, while turning is in progress, if required, through electro-magnetic clutches, either by depression of a push-button or by another adjustable stop. The 24 spindle speeds available, from 98 to 2,000 r.p.m., are divided into high and low ranges, and are selected by levers on the headstock. An electro-magnetic brake is provided for the spindle.



Köping Type HKS-2 Hydraulic Copying Lathe

Headstock gears are of alloy steel, hardened and ground, and the shafts on which they are mounted run in ball bearings. The headstock spindle is bored 2⅜ in. diameter and has a standard American type A2 taper nose. Double-row cylindrical roller bearings are employed, and end thrust is taken on angular contact ball bearings. An air-operated chuck is fitted, and may be arranged for hand or foot control.

From the headstock, drive is taken by gears to the feed box, which gives nine sliding feeds ranging from 0·002 to 0·03 in. per rev. If required, the sliding feeds can be reduced in the ratio of 1·38 to 1 during the cutting cycle, under the control of an adjustable stop. Rapid power traverse of the copying slide at the rate of 118 in. per min. is

available, and may be brought into use automatically at the end of the cutting stroke, or as required, by depression of a push button.

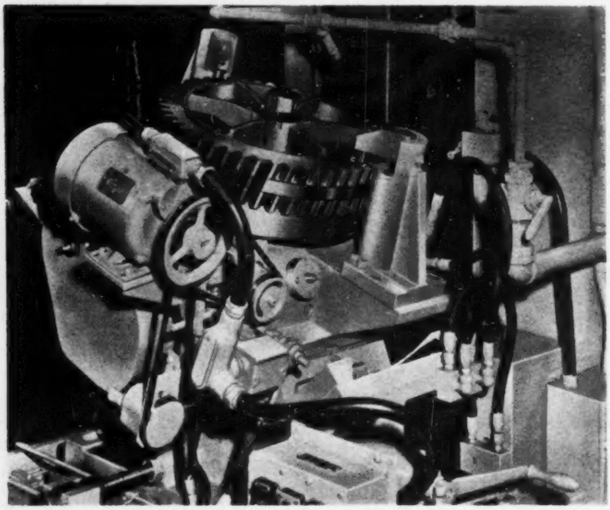
Electrical equipment is housed in a cabinet at the rear of the lathe, and push-buttons for controlling the various motions are conveniently grouped at the front of the base.

Mortimer Engineering Co., 204-206 Acton Lane, Harlesden, London, N.W.10, are the selling agents in this country for Köping lathes.

Colonial Indexing Table

Developed by the Colonial Broach & Machine Co., Detroit, Michigan, U.S.A., for use originally in connection with broaching operations, the patented indexing table here shown permits workpieces to be positioned for angle to a high degree of accuracy. It is made in three sizes, with capacities for parts of 11, 18, and 28 in. diameter.

Steplessly-variable indexing movements are obtainable which provide for any number of divisions from 21 to 250. The unit incorporates a worm-wheel and opposed worms which are coupled to a continuously-running driving motor by two slipping clutches. With this arrangement, the driving worm is brought into use for indexing the table, only when the opposing worm is released. When the table is set in the working positions, backlash between the worms and worm-wheel is eliminated by the action of the motor and clutches.



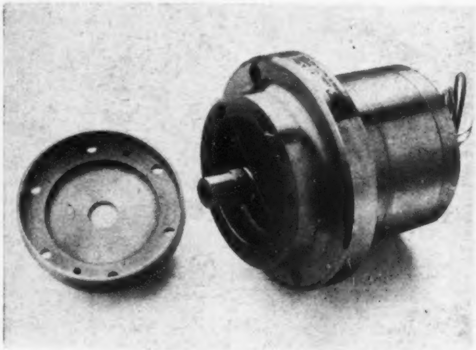
Colonial Indexing Table

The table and drive assembly is mounted on a cradle so that it can be tilted, as shown.

Gaston E. Marbaix, Ltd., Devonshire House, Vicarage Crescent, London, S.W.11, represent the Colonial Broach & Machine Co. in this country.

Tower High-frequency Spindles

Tower Engineering Co. (Northwood), Ltd., Ferndown, Joel Street, Northwood, Middx., are producing high-frequency spindles for speeds up



Tower High-frequency Spindle Unit with End Cap Removed

to 90,000 r.p.m. The illustration shows a unit with a maximum diameter of 6 in. and an overall length of 7¼ in., designed for a spindle speed of 30,000 r.p.m. on 1,000 cycle supply.

The end cap of the unit has been removed so that some of the internal features can be observed. Specially-selected high-grade ball bearings made by Fafnir, or EMO of Bracknell, are employed for the spindle. The bearing balls are mounted in a cage and outer race, and run directly in a track ground in the spindle extension, as shown. This arrangement enables the overall diameter of the bearing assembly to be reduced, and provides a supporting system of great rigidity. Lubricant is supplied, in the form of oil mist, by Norgren equipment.

Current supply for the spindles of this type, which can be supplied in sizes from fractional up to 6 h.p., is

provided by a 1,000-cycle alternator, driven by an A.C. motor of normal frequency. Excitation for the alternator is usually provided by selenium rectifiers.

Wickman Erodosharp Mark 2 Spark Erosion Machine

The Erodosharp spark erosion machine introduced some six years ago by Wickman, Ltd., Tile Hill, Coventry, for sharpening carbide-tipped single-point cutting tools, has recently been the subject of some design improvements, and the latest type, designated Mark 2, is shown in the figure. Various aspects of tool sharpening by spark erosion, and the advantages obtained by the process, were discussed in an article in MACHINERY, 92/136—17/1/57, which was based on material supplied by Wickman Ltd.

Wickman Erodosharp Mark 2 Spark Erosion Machine for Sharpening Carbide-tipped, Single-point Cutting Tools

There are two 9-in. diameter electrode wheels, driven by a ⅓-h.p. motor, on the Mark 2 machine, and adjustable work tables are provided which enable positive rakes up to 15 deg. and negative rakes up to 5 deg. to be obtained on cutting tools. Electrical equipment for providing the spark discharge between the electrode and cutting tool has a rating of 1½ kVA., and is housed in the cast iron base, whence it can readily be removed as a single unit, to facilitate maintenance. A rotary selector switch, with three positions, designated "coarse" "medium" and "fine," is mounted on the front of the base, and serves for adjusting the intensity of the spark discharge, and, consequently, the rate of metal removal and the quality of surface finish obtained on the work. Dielectric fluid, through which the spark discharge takes place, is delivered between the electrode wheels and the cutting tools by a gravity feed system, and is contained in a tank of 7 gal. capacity housed in the base. Provision is made for varying the supply of fluid to the electrodes, independently. The light-alloy electrode head incorporates detachable splash guards, and a built-in motor-driven fume extraction system is provided. Conveniently-placed push-buttons are fitted for controlling the motors for the electrode drive and the fume extraction system.

The machine occupies a space of 30½ by 20⅝ in., and the height of the electrode centre-line from the shop floor is 42 in.

Racal MA. 38 Tachometer

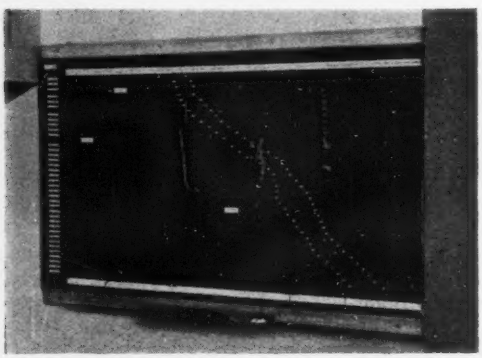
Intended for use in conjunction with Racal digital frequency meters, types SA. 20 and 21, the MA. 38 tachometer shown in the accompanying illustration will give a direct reading of shaft speeds from 100 to 20,000 r.p.m. This tachometer has been developed by Racal Engineering, Ltd., Western Road, Bracknell, Berkshire, and has a rotor with 60 teeth, which, when direct-coupled to a rotating shaft, gives an output of 60 pulses for each revolution. These pulses are fed to a frequency meter, from which a reading of the shaft speed in r.p.m. can be obtained.

The instrument can be employed for measuring other quantities, such as linear speed, after conversion into rotary motion, and is suitable for use with all digital frequency meters which have a 1 sec. time base.

Racal MA. 38 Tachometer

Adapta-Charts " Continuous " Wall Chart

A " continuous " wall chart, which permits unbroken continuity of plotting from one time-period to the next, has been developed by Adapta-Charts, Ltd., 129 Hammersmith Road, London, W.14. For this system, which is an addition to the existing Movigraph range, a series of panels is fitted into horizontally-channelled wooden sections fixed to the wall. When the time-period covered by the first panel has expired, that panel is removed, and the remaining sections are pushed to the left, thereby leaving a vacant panel space at the right-hand end. A fresh panel, representing a new time-period, is then inserted in this space. Signals can be fitted in the perforations provided in each panel, and a series of interlocking plastics trays for holding the signals is available as an optional extra. The portion for holding title frames is permanent,



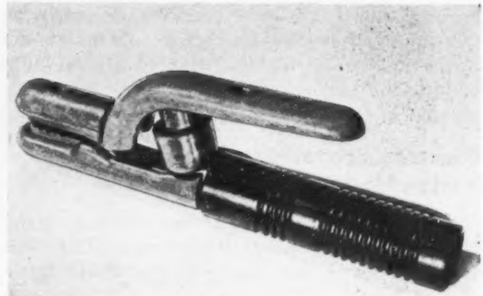
Adapta-Charts " Continuous " Wall Chart

and separate from the remainder of the system.

The accompanying illustration shows a typical chart. Machine loadings, and other engineering data requiring visual representation of time-periods can be indicated by this system.

Lincoln Jackson Electrode Holders

Following the introduction of the Jackson A.3.S. electrode holder, Lincoln Electric Co., Ltd., Welwyn Garden City, Herts., have begun manufacture of two smaller types, known as the A.W. and the J.H.2. Both these holders have crown channel type jaws of 98 per cent copper alloy, and are effectively insulated with fibre-glass reinforced plastics, so that full protection against accidental arcing is afforded.



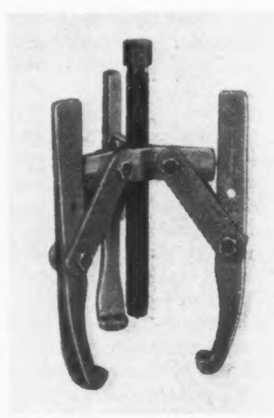
The Lincoln Jackson Type A.W. Electrode Holder

The type A.W., which is shown in the figure, is a medium class holder for operation with currents up to 300 amp. It will take ¼-in. electrodes, weighs 14 oz., and is 9¾ in. long. Rated for operation at 200 amp., the J.H.2 holder will take $\frac{5}{32}$-in. electrodes. It is 8 in. long, weighs 9½ oz., and is claimed to reduce operator fatigue when working under difficult conditions.

Martindale Wheel-puller

The illustration shows a 20-ton, triple-grip, 12-14-in. capacity wheel-puller, which is the largest of three sizes introduced by Martindale Electric Co., Ltd., Westmoreland Road, London, N.W.9. Other sizes available are of 5-ton, 6-in. and 10-ton, 8-in. capacity, and all these tools can be supplied with either a twin or triple grip, as required. The maximum reach of the pulling arms ranges from 3¼ in., for the smallest size, to 15 in. for the largest, with the arms at minimum spread.

High-grade alloy steel drop forgings are used for all parts, except the forcing screws, which are of high-tensile steel. The puller here shown has a forcing screw of 1 in. diameter by 12 in. long.



Martindale 20-ton, 12- to 14-in. Capacity Triple-grip Wheel-puller

Machining Crankshafts with Carbide Tools on Single-purpose Lathes

For machining the crankpins of forged steel motor car crankshafts with cemented carbide tools, the Machine Tool Division of Wickes Corporation, Saginaw, Mich., U.S.A., has supplied a group of four single-purpose lathes, as shown in Fig. 1, to Pontiac Motor Division, General Motors Corporation, Pontiac, Mich. Each lathe machines one crankpin of a 4-throw crankshaft for a V-8 engine.

A 60-h.p. D.C., variable speed motor is provided for each lathe, and the work is driven from both ends. A three-to-one speed range is available which enables facing and plunge-forming to be carried out at a cutting speed of 250 surface ft. per min.

The operating cycle of each machine in the line is automatic and independent. Crankshafts, with the main bearing surfaces already machined, are loaded into V-notches along the first section of the automatic conveyor seen at the right in Fig. 1. As the shafts are placed on the conveyor they are automatically advanced, in steps, up to a transfer point in line with the first lathe. This movement continues until the first section of the conveyor is fully loaded.

Each crankshaft is elevated when it reaches the No. 1 loading station. A loading arm then descends, and a pair of fingers grip the shaft on the No. 1 and 4 main bearing surfaces and raise it. Next, the loading head moves, on an overhead cross-rail, about 5 ft. to the left, until the crankshaft is aligned with the working area of the machine. In this position, the loading arm lowers the crankshaft and deposits it in the work-cradle of the lathe.

After the crankshaft has been seated in the work-cradle, it is automatically clamped, as seen in Fig. 2, and the cutting tools are advanced. At this first station, the crankshaft is hydraulically clamped on the No. 2, 3, and 5 main bearings.

No centres are required for supporting or locating the crankshaft in the work-cradle, and it is suggested that the centring operation be eliminated by using a similar machine line for turning the main bearings.

Two carbide cutting tools are provided on each lathe, and are applied to the work from the front and the rear. These tools are carried by slides which are moved by means of a hydraulic cylinder, acting through a cam-bar. Two circular inserts and one triangular insert are mounted in the front-slide tool as seen in Fig. 3. The circular inserts take facing cuts across the counterweights, and the triangular insert plunge-forms the centre portion of the crankpin. Two triangular inserts on the rear-slide tool, also shown in Fig. 3, plunge-form the remainder of the pin. Areas machined by these two inserts, and by the single triangular insert in the front-slide tool, overlap. Both the tools

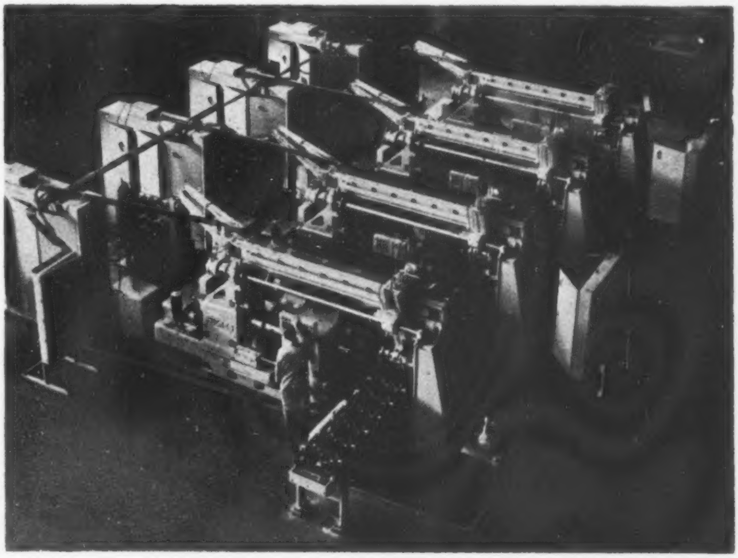


Fig. 1. An Installation of Automatic Lathes Each of which Machines one Crankpin of a 4-throw Crankshaft

already mentioned are of the Wesson multi-cut type.

Each of the circular inserts is held at a slight angle to provide the required negative rake, whereas triangular inserts have a small positive rake. The rate of feed for plunge-forming is 0·010 in. per rev., and during the initial tool movement, involving an interrupted facing cut, the feed ranges from 0·040 to 0·060 in. per rev. For an average crankpin, the depth of the plunge cut is 0·25 in.

The tools are advanced, to complete the cut, and are withdrawn, in less than 1 min. When the work-cradle has come to rest, the clamps are released and an unloading arm moves down. A pair of fingers grip the crankshaft and raise it clear of the lathe. Next, the front arm descends and reloads the work-cradle with another crankshaft. The cross-head then moves to the right, the unloading arm deposits the machined crankshaft on the conveyor leading to the next lathe, and the loading arm picks another shaft.

Apart from the fact that each is arranged to machine a different crankpin, the remaining lathes are identical with that described. The capacity of the conveyor line is 32 crankshafts, so that there is a stock of eight for each machine, and the hourly output of the installation is 50 crankshafts.

When one of the lathes is stopped for tool changing, which occupies only 5 min., operation of the remainder is not interrupted.

When a lathe is started up again, each crankshaft delivered from it to the conveyor is automatically advanced to fill the vacant position nearest to the next loading station. Thus, any gaps on the transfer line are eliminated, and full production is resumed.

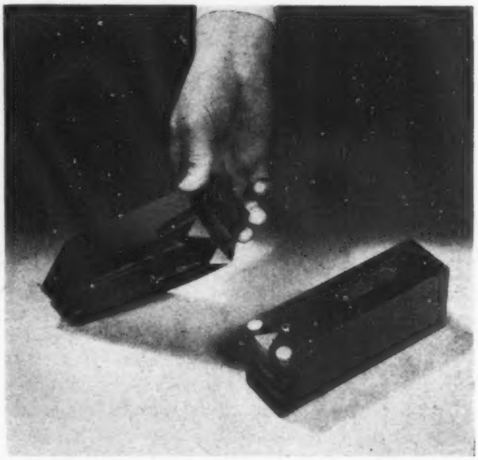


Fig. 3. Front- (right) and Rear-slide Tools for Machining Crankpins. Standard Carbide Inserts are Employed

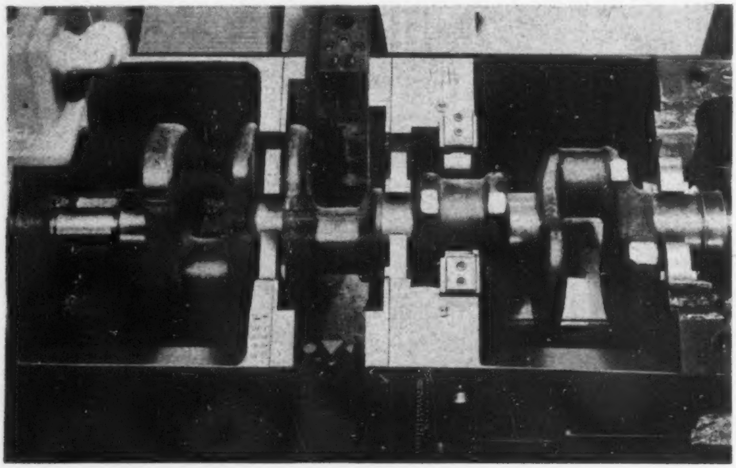


Fig. 2. A Close-up View Showing the Crankshaft in Position in the Work Cradles on the First Lathe

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New De-icing Coating.—Technologists at the Battelle Institute, U.S.A., have developed an improved de-icing coating for aircraft windscreens. Hitherto, coatings with a transparency equivalent to the new type could only be obtained by employing a coating temperature of 800 deg. F., but the new coating technique makes use of temperatures between 250 and 400 deg. F., so that, although the coating is highly transparent, the glass of the windscreen is not distorted. The coating consists of a microscopically thin layer of indium, which transmits about 85 per cent of the light striking the glass. The coating is durable, and can be heated to a temperature that is sufficiently high to boil water.

Developments by William Jessop & Sons

Wm. Jessop & Sons, Ltd., Brightside Works, Sheffield, have concentrated, in recent years, on the manufacture and marketing of steel and special metals to meet particular requirements. In this connection, extensive research facilities have been necessary, and some 190 physicists, metallurgists, chemists, engineers and other technologists are now employed in the company's research laboratories.

Three items of special importance at present are the Vacumelt process of vacuum melting, developed by the company, the manufacture of titanium and its alloys, and the manufacture of zirconium.

RESEARCH DEPARTMENT

The present Research Department had its beginnings in the early 1930's, and was rapidly expanded when the company entered the field of high temperature steels and alloys. In 1950, Whiston Grange, near Rotherham, was adapted as a research laboratory for long-term investigational and development work, and 50 members of the research team are housed here.

With the development of heat resisting materials, there has been a continually increasing demand for creep testing facilities, and the company now have more than 200 creep units in constant use.

VACUUM MELTED STEELS

With vacuum melted steels, the immunization heat treatment processes are avoided and low hydrogen content is ensured. The process gives freedom from harmful non-metallic inclusions, with consequent reduction of scatter and considerable improvement in mean strength. Creep resistant alloys may be melted under vacuum to compositions not possible with air melting techniques, so that materials with increased creep strengths may be produced.

For highly-stressed components, the properties of vacuum melted steels are of great value. One example is afforded by ball bearings and ball races, the life of which, it is stated, may be increased four-fold. Vacuum melted steels are also finding increasing applications in the aircraft industry, where high temperatures and high stresses are encountered and increasing periods without maintenance are demanded. In addition, these steels can be employed with advantage for highly-stressed components of steam generation plant, plastics moulds, extrusion dies, and parts which must be highly polished.

The methods adopted by William Jessop for vacuum melting are: (1) the consumable arc melting process, whereby air melted material is used as an electrode and re-melted under vacuum. By this method ingots weighing 30 cwt. can now be produced, and with new plant, which is being installed, it will be possible to increase this figure to 3 tons, (2) the high-frequency induction process, whereby complete melting from raw materials and subsequent casting of the ingot is carried out in an evacuated chamber.

TITANIUM

Production plant for titanium was installed in 1954, as a private venture, at a cost of some £300,000. Following the reduction in the defence programme, additional outlets are being sought, for example, in marine and chemical engineering.

Titanium must be melted in the absence of air because the liquid metal is highly reactive. If air is present even in small quantities enough oxygen

Ultrasonic Inspection of a Large Titanium Slab at the Works of William Jessop & Sons, Ltd.

may be dissolved to render the resulting metal hard and brittle. Jessops have adopted a double melting technique, an ingot from the first melt being employed as an electrode for the second. A homogeneous alloy is thus ensured, with the minimum of impurities. For example, the total hydrogen and nitrogen content of a typical melt is only 160/170 parts per million.

The company are now marketing seven grades of titanium and titanium alloys under the trade name of Hylite as follows: No. 10 and No. 15 are commercially-pure grades of titanium with different hardness ranges, No. 15 having the higher tensile strength; No. 20 contains aluminium and tin as alloying additions, and has greater strength than either No. 10 or No. 15; No. 30 contains 2 per cent of aluminium and 2 per cent of manganese; No. 40, with a higher strength and greater creep resistance than No. 30, contains 4 per cent of aluminium and 4 per cent manganese; No. 45 is a 6 per cent aluminium, 4 per cent vanadium alloy, which has slightly greater strength than No. 40, and can also be welded; and No. 50, which has been specially developed in the Whiston research laboratories for good creep resistance, is a complex alloy containing molybdenum, silicon, tin and aluminium.

ZIRCONIUM

Zirconium production presents problems similar to those encountered with titanium, in that the metal has a great affinity for oxygen and nitrogen, and must be melted under vacuum.

It is not a light metal (the specific gravity is 6·5), and is mainly required for atomic energy applications. Zirconium and zirconium alloys have good corrosion resistance and low neutron absorption value, and can therefore be used with advantage in atomic reactors.

KRYPTON LIGHT SOURCE FOR INTERFEROMETRY.—It is reported that the Sheffield Corporation, U.S.A., a subsidiary of Bendix Aviation Corporation, recently received two Krypton 84 isotope light sources for use in interferometry work at their Eli Whitney Metrology Laboratory. These sources have been specially developed by the West German Bureau of Standards to provide light of maximum purity.

Hitherto, the laboratory has employed an isotope of mercury, developed by the U.S. Bureau of Standards. It is believed that the very good results, as regards visibility and definition of interference bands, that have been obtained, will be surpassed by the new source.

Radyne Induction Heaters

The illustration shows one of three types of 1-kW. induction heaters manufactured by Radio Heaters, Ltd., Eastheath Avenue, Wokingham, Berks.

Vacuum tubes can be de-gassed in the type C.9/A unit, which is capable of heating a ⅜-in. diameter carbon anode to 1,150 deg. C., inside a 2-in. diameter glass envelope. The type C.9/B equipment is a 5 Mc/s laboratory furnace, for such purposes as hydrogen and carbon determination of steels. The third unit, type C.9/C, is designed for soldering and brazing small components. Both the C.9/A and C.9/C equipments have facilities for varying the work coil KVA., according to the application for which they are being used. The power supply of these 1-kW. induction heaters incorporates metal rectifiers, in place of the conventional transformer and valve rectifier. The units are designed for operation on supplies of 250 volts, 50 cycles, and require a small cooling water supply at a pressure of 20 lb. per sq. in.

The overall dimensions are 33 in. high, 16 in. deep, and 21 in. wide, and the weight is approximately 120 lb. A trolley frame, with four rubber-covered wheels, is available as an optional extra.

Radyne Type C9/A 1-kW. Induction Heater for Vacuum Tube De-gassing

Machine Shop Patents

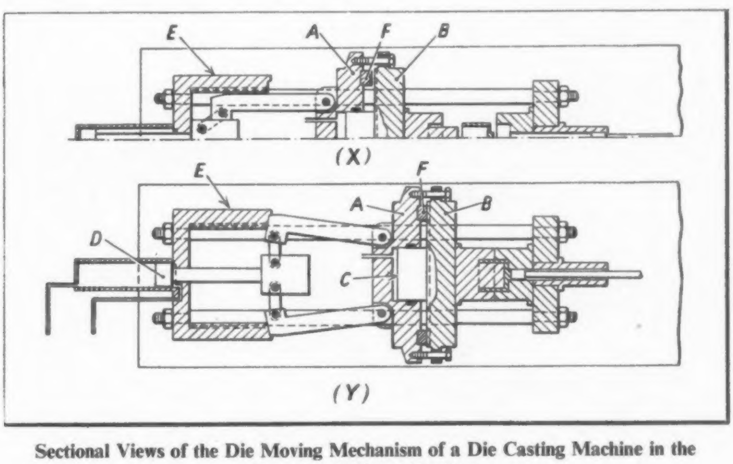
LOCKING MECHANISM FOR A DIE CASTING MACHINE

The sectional views at *X* and *Y*, in the accompanying figure, show the die-moving mechanism of a die casting machine, in the open and closed positions. Referring to the view at *X*, the movable die platen is in two parts, *A* and *B*, and these parts can be separated by the admission of hydraulic pressure oil to the chamber *C*. The extent of this movement is limited by the bolts seen at the periphery of the platen. Movement of the platen as a complete unit, is effected by the double-acting hydraulic piston *D*, which is connected to the platen *A* by arms and toggle levers.

When the mechanism is in the closed position, as shown at *Y*, these toggle levers spread the connecting arms, so that their ends abut against sloping shoulders on the cross-head *E*. Pressure oil is then admitted to the chamber *C*, with the result that the member *B* moves to the right, and completes the closure of the die. Next, hydraulically-operated wedges, *F*, are forced between the members *A* and *B*, thus locking the entire mechanism. This locking action is independent of any positional changes in the remainder of the mechanism, which may be caused, for example, by thermal expansion of the various members. In addition, the locking action is unaffected by variations in pressure of the hydraulic oil, and the wedges *F* provide a self-sustained clamping action.

To open the dies, the pressure in the chamber *C* is raised slightly, so that the wedges *F* can be withdrawn, and the oil is then exhausted from the chamber. The opening movement is completed by a reverse motion of the piston *D*.

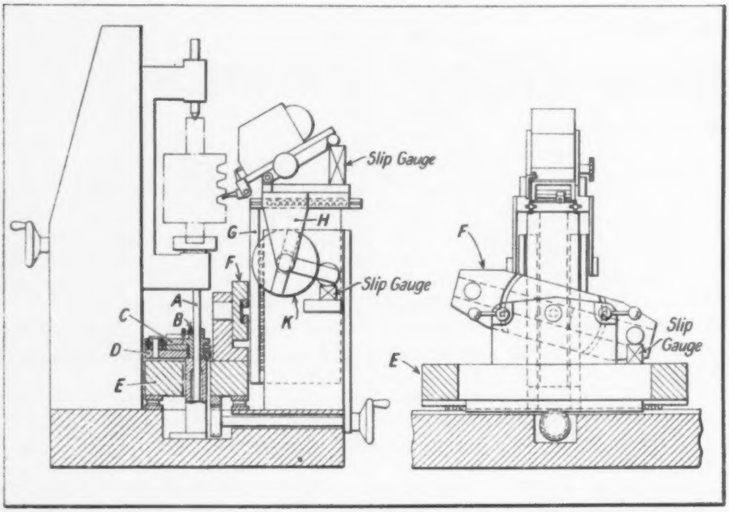
786,248. G. Buhler, Uzwil, Switzerland. [*Application date, March* 3, 1955. *Published date, November* 13, 1957.]



Sectional Views of the Die Moving Mechanism of a Die Casting Machine in the Opened and Closed Positions

A HOB TESTING MACHINE

In the accompanying drawings are shown part-sectional front and side views of a machine for inspecting hobs for lead, base and pitch errors. The hob is carried between centres, on a vertically-adjustable slide, and is direct-coupled to the shaft *A*, which is supported in a bearing housing bolted to the base of the machine. A boss *B*, with large and small rolling diameters, is fixed to the shaft *A*. The rolling bars *C* and *D* contact the boss *B*, and are attached to the slide *E*, which can be traversed horizontally by means of a rack and pinion. The length of each rolling bar is equal to several times the circumference of its mating diameter on the boss *B*, and the bars are held into contact with the boss surfaces by ball bearings and a pre-loading mechanism (not shown). According to the diameter of the hob to be tested, the large or small diameter of the boss *B* is used, and when the slide *E* is traversed, the shaft *A* is rotated. Also attached to the slide *E* is a bracket, on which the swivelling beam *F* is pivoted, and this beam can be clamped, after it has been set for angle of inclination with slip gauges. The vertically-moving slide *G*, which carries the indicating unit, has a pin engaging with a lengthwise slot in the beam *F*.



Part-sectional Side and Front Views of a Machine for Inspecting Hobs

Horizontal traverse of the slide *E*, therefore, will cause the slide *G* to rise and fall, to the extent of the inclination of the beam *F*.

The indicating-unit is arranged for lengthwise adjustment, and is mounted on a hinged plate, the inclination of which can be set by means of slip gauges. This complete assembly is carried on a horizontally-movable saddle, which has arms *H*, with pins engaging in slots in the discs *K*. The inclination of these slots can be set by the use of slip gauges, in conjunction with the arms and rollers attached to the discs *K*. As the slide *G* rises and falls, the indicating-unit saddle is moved towards, and away from, the hob-axis, to the extent of the inclination of the slots in the discs *K*. The indicating stylus must be off-set to the hob-axis, by means of an adjustment, so that the contact-point is in a plane tangential to the hob base-circle.

787,149. W. Ferd. Klingelnberg Sohne, Remscheid, Germany. *[Application date December* 11, 1954. *Published December* 4, 1957.*]*

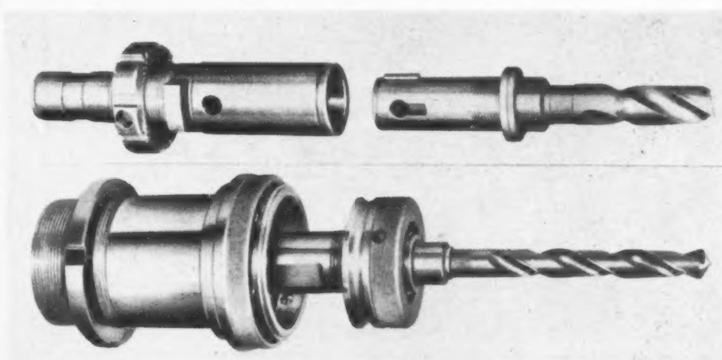
Chucks for Pre-set Cutting Tools

Scully-Jones & Co., Chicago, Ill., U.S.A., have introduced a range of chucks with facilities for pre-setting end-working cutting tools, for use on multi-spindle automatics.

By means of these chucks, pre-set cutting tools can be quickly mounted on the tool slide of the automatic, and may then be brought into use without the need for further adjustment. While the automatic is in operation, fresh cutting tools can be pre-set in other chucks, in readiness for subsequent use, with the aid of a gauge.

The chucks are made in two types, one of which, shown in the upper view in the figure, is intended to be loaded into and removed from the tool block from the rear end. Chucks of the type seen in the lower view are loaded into and removed from the tool block from the front end. Both types will take cutting tools of various diameters.

Henry Challis, Ltd., Devonshire House, Vicarage Crescent, London, S.W.11, are the distributors in this country for equipment made by Scully-Jones & Co.



Scully-Jones Chucks for Pre-set Cutting Tools

The Production of Sample Stampings by Hydroforming

By T. C. BARRETT*

More frequent changes in the design of motor-car components have caused tooling costs to rise rapidly and have made it difficult to maintain delivery schedules. Engineers at the works of the AC Spark Plug Division of General Motors Corporation, U.S.A., have solved these problems in connection with deep-drawn parts and irregularly-shaped stampings by employing Hydroforming to produce prototypes and short-run production samples.

In Hydroforming, blanks are formed to the shape of the punch by controlled hydraulic pressure which is transmitted through a flexible die member. Operations are performed on a Hydroform machine made by the Process Machinery Division of Cincinnati Milling Machine Co. The matching die and pressure-pad required in conventional deep-drawing work are not needed with this method.

These units are replaced by a built-in, pressurized forming cavity, sealed by a flexible rubber diaphragm, which serves as a universal die and pressure-pad for a part of any shape.

It has been estimated that the cost of making parts in this way, including the charge for a punch and draw-ring, is only about one quarter of that of purchased samples. Moreover, the cost of conventional, permanent tools to produce the same parts would be as much as 20 times or more than that of Hydroforming tools. The latter comparison does not, of course, represent actual savings, since production tools are built for many parts that were originally made on the Hydroform machine. In all cases, however, the permanent tools could not have been finished in time to make production samples.

One of the many parts produced at the AC works by the controlled-pressure, hydraulic forming method is the Cadillac air cleaner shroud seen in Fig. 1. Blanks of 24 in. diameter with a 3-in. diameter centre hole were used. A total of 27 parts was produced from 0·018-, 0·025-, and 0·0295-in. thick blanks of cold-rolled steel, using a forming punch of low melting point alloy (Cerromatrix). This punch and the draw-ring cost only 378 dollars, whereas the cost of the three permanent production dies subsequently required amounted to 18,000 dollars.

* AC Spark Plug Division, General Motors Corporation, U.S.A.

VERSATILITY OF THE HYDROFORMING PROCESS

Versatility is an important feature of this process. It is not limited to the production of round or symmetrical parts, and a wide variety of types and thicknesses of material—up to $\frac{3}{8}$-in. thick mild steel and $\frac{5}{8}$-in. thick aluminium—can be handled. At the AC works, parts have been made from 0·018-, 0·025-, 0·031-, and 0·062-in. thick blanks with the same tools. When more than one draw is required, a stack of two or more blanks can be pre-formed at one time. Thin parts can be pierced and trimmed during forming, and holes can be extruded by means of piloted plugs which force the material into recesses in the punches.

Fewer operations are generally required, and initial reductions of 50 to 70 per cent are normal. Intermediate annealing operations, sometimes required with conventional methods for severe form-

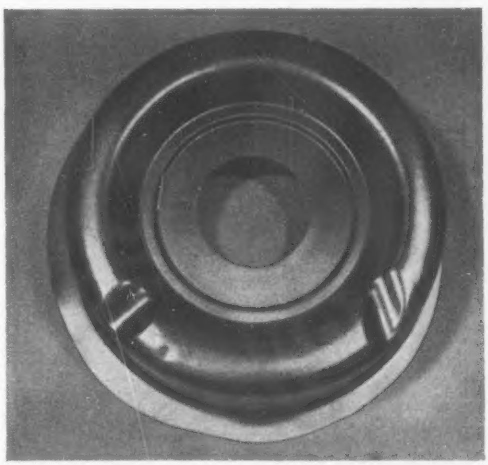


Fig. 1. The Punch and Draw-ring for Hydroforming this Cadillac Air Cleaner Shell Cost only 378 Dollars. Permanent Production Tools for the Same Part Cost 6,000 Dollars Each

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ing and deep-drawing, are eliminated. In many instances, thinner blanks of smaller diameter can be used, so that material is saved. Since there are no die marks, parts of improved quality can be obtained with little or no polishing. Parts can, indeed, be Hydroformed after the material has been painted, plated, or polished.

Uniform working during hydraulic forming under controlled pressure serves to retain the mechanical and physical properties of the material. Since material is displaced rather than stretched, there is a minimum of localized thinning. In addition, spring-back is minimized, so that improved dimensional accuracy can be obtained.

Hydroforming permits rapid conversion of design ideas into prototypes. Many modifications of an original design can be made with a minimum of cost and tooling changes, and different types and thicknesses of materials can be tested. The quality and appearance of the part produced are much better than if it is made by hand hammering or spinning. Finished parts can be used for permanent tool lay-outs and press try-outs. Many of the tools are interchangeable or can easily be modified to suit different parts, so that tool and development costs are reduced as additional parts are produced by this method.

DETAILS OF OPERATING CYCLE

In operation, the blank is placed on the top surface of the draw-ring, and the press dome containing the flexible die member is lowered. When it is in the forming position, the dome is locked, and an initial pressure is applied to force the under-side of the outer edge of the part against the draw-ring, to prevent wrinkling during forming. After the pressure has reached a pre-set value, the punch is moved upwards, and the flexible diaphragm forms the blank. The displacement in the hydraulic cavity, during what is termed the natural cycle, causes the pressure to increase, and uniform forces are exerted on the part from all directions.

Fig. 2. The Press Dome Containing the Flexible Die Member is here Shown in the Raised Position, and the Punch Lowered to Strip the Finished Part. Locking Cams Hold the Ram in Open Position

Forming pressure can also be controlled automatically, and is normally increased during the drawing operation to decrease the corner radius formed on the part by the die. This "edging" method of controlling the radius on the flange involves the application of pressure while the punch is moved down slightly. The amount of punch movement depends on the metal thickness, the radius required on the work, and the radius on the draw-ring. Pressure exerted during forming is automatically controlled by a flat cam which is mechanically connected to the lower hydraulic ram. Adjustable set-screws, extending from the cam, contact a pressure valve, and the pressure is raised or lowered, depending on the setting of the screws. A drum cam with T-slots for holding adjustable dog-type stops is also provided. One stop controls the height to which the punch is raised, a second, edging stop provides for sharpening the drawing radius, as explained, and a third stop controls the automatic stripping of the formed part from the punch.

When forming has been completed, the pressure is released and the dome raised. The punch is then lowered, as seen in Fig. 2, to strip it from the finished part. For safety, the upper ram is held in the open position during loading and unloading by four locking cams. These cams also engage grooves in the press columns to lock the ram in the closed position during the forming operation.

The Hydroform machine employed at the AC works is the largest of its type made. Blanks up to 32 in. diameter can be drawn to a maximum depth of 12 in. with punches ranging in size up to 26 in. diameter. The maximum dome-cavity pressure is 10,000 lb. per sq. in., and the machine can be operated at 90 cycles per hour.

EXAMPLES OF PARTS PRODUCED

In forming the shroud seen in Fig. 1, an initial holding pressure of 500 lb. per sq. in. was exerted to clamp the blank. The pressure was then increased to 1,000 lb. per sq. in. under cam control.

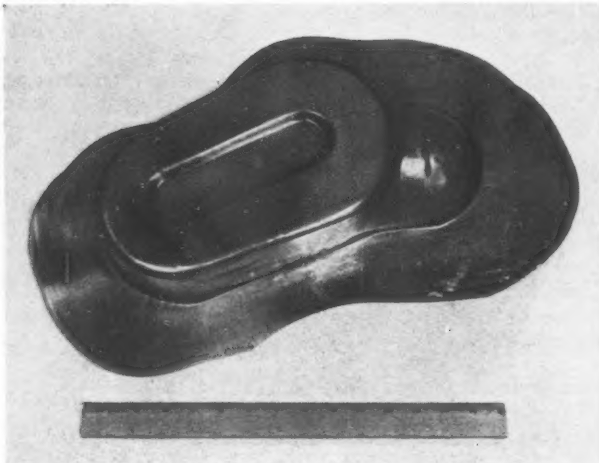


Fig. 3. The Lower Shroud for a Corvette Air Cleaner Hydroformed from a 0·031-in. Thick Cold-rolled Steel Blank. Auxiliary Rings were Employed for Ironing this Component

As the punch was raised 3 in. into the flexible diaphragm, the pressure was allowed to increase to 8,300 lb. per sq. in. as a result of displacement.

A more complex part made by Hydroforming is the lower shroud for a Corvette air cleaner, which is shown in Fig. 3. The shroud was made from 0·031-in. thick cold-rolled steel, and the blank size was determined by adding 3 in. to the basic dimensions of the part. To assist in preventing the formation of wrinkles during the forming of this part, a half-ring and two strips (of $\frac{1}{16}$ in. thick sheet metal) were placed between the flat blank and the flexible diaphragm. The half-ring was placed near the rear edge of the blank, and the two strips at the toe.

An initial holding pressure of 200 lb. per sq. in. was applied. Then, with the natural cycle, the pressure was allowed to increase to 1,800 lb. per sq. in. during a punch travel of $1\frac{9}{16}$ in. At this point, the blank reinforcing ring was removed, and the pressure was increased to 2,200 lb. per sq. in. without movement of the punch. The natural cycle was then resumed during a punch travel of $\frac{5}{8}$ in., whereby the pressure was increased to 3,100 lb. per sq. in. After moving the two strips at the toe further out on the blank, the punch was raised another $\frac{1}{2}$ in. with a resulting natural increase in pressure to 4,000 lb. per sq. in. The strips were then removed, the pressure was increased automatically to 4,400 lb. per sq. in., and the natural cycle was continued until drawing had been completed. Finally, the shrouds were ironed with auxiliary rings at a pressure of 200 lb. per sq. in. For this particular part, the Hydro-forming tools cost only one-tenth as much as permanent production dies.

Another example of successful Hydroforming is afforded by the chamber cover for a Chevrolet air cleaner, illustrated in Fig. 4. A total of 65 parts of 13 in. diameter by $2\frac{1}{2}$ in. deep was made from 0·031-in. thick tinned SAE 1008 steel. Each blank was produced from a 20-in. square with a 2-in. diameter centre hole, by trimming one half to a semicircular shape. The forming punch was made from a low-melting-point Cerromatrix alloy. Pressures employed varied from 400 (holding) to 8,000 lb. per sq. in. A rubber insert was placed on the punch at the point where the deepest depression was to be formed to prevent excessive

Fig. 4. For this Air Cleaner Cover, a Forming Punch Made from a Low Melting-point Alloy was Employed, and the Final Pressure was 8,000 lb. per sq. in.

metal flow into the punch cavity. After the depression had been drawn to a depth of about 1 in., the rubber insert was removed, and the draw completed with the natural cycle.

TOOLING FOR HYDROFORMING

Punches may be made from cold-rolled steel, cast-iron, tool steel, Kirksite, Cerromatrix, plastics, brass, aluminium, or hard wood. The choice of punch material depends on the work material, the quantity of parts required, the shape of the part, and the severity of the draw. A punch is secured either by a screw thread, or a stud attached to an extension of the forming piston located beneath the press bed.

Draw-rings are generally made from cast iron or steel, and hardened if required. They are placed over the punches and rest on the draw-ring support (bolster plate). Clearance between the punch and draw-ring is not critical and may be 50 per cent or less of the thickness of the material to be formed. Undercut draw-rings, such as that shown at the top in Fig. 5, are used to eliminate overhang, and are sometimes of assistance when forming odd-shaped parts. Contoured draw-rings, as shown in the lower views, are also useful when forming parts with irregular contours.

For very short runs, a top plate may be placed on an existing draw-ring, as shown in Fig. 6. The overhang of the top ring should not exceed its thickness, and the plate must be smaller in diameter than the outside diameter of the draw-ring to clear the edge of the dome. Since there is no way of connecting the top plate to the draw-ring without spoiling the ring, rubber strips are placed on top of the blank to break the vacuum caused by dome action during drawing. Methods of locating the blank include counterboring the draw-ring to a depth equal to the material thickness, or providing pins, brackets, fixtures, or plugs on the ring. Pins, brackets, or fixtures should not be higher than the thickness of the blank. It will be appreciated that plugs can only be employed for locating purposes when the necessary mating holes are required in the blanks.

AVOIDING OVERHANG OF BLANK

Excessive overhang of the blank between the draw-ring and punch, as illustrated at *A* in Fig. 7, should be avoided, since it may result in rupture of the metal or wrinkling. Such overhang can be avoided by pre-forming with a smaller-bore draw-ring, as at *B*, and finishing at a second operation, as indicated at *C*. An alternative method would be to use a dome-shaped punch with the smaller-bore draw-ring for pre-forming.

Another method of avoiding excessive overhang is to employ double-acting punches, as seen in Fig. 8. With the design at the left, the inner punch draws the upper portion of the part, and the outer punch forms the remainder. If required, a tool of this type can be so designed that the part is pinch-trimmed. With the design at the right, the ram raises the inner punch to form the upper portion of the part. Subsequently, the support pins raise the outer punch to complete the operation. The travel of the support pins is equal to the depth of the second draw.

A larger radius is generally required on the punch and draw-ring when the overhang is considerable. If the radius of the draw-ring is too great to obtain the desired flange radius on a part, secondary tooling may be needed. One method of increasing the metal flow during Hydroforming is to cut off the corners of the blank, thus reducing the area of the blank so that a smaller holding force suffices. Draw-beads can be provided to decrease the flow of metal in selected areas. The amount of drawing compound employed is

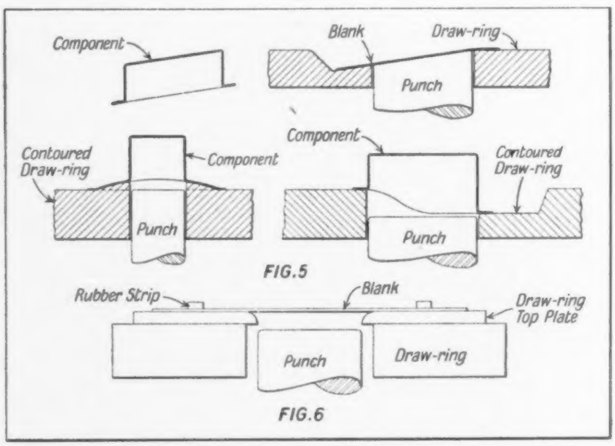


Fig. 5. Undercut (top) or Contoured (bottom) Draw-rings are Sometimes Used to Eliminate Overhang of Blank, or to Facilitate Forming Odd-shaped Parts. Fig. 6. A Plate Can be Placed on Top of an Existing Draw-ring for Hydroforming a Few Parts. Rubber Strips are Placed on Top of the Blank

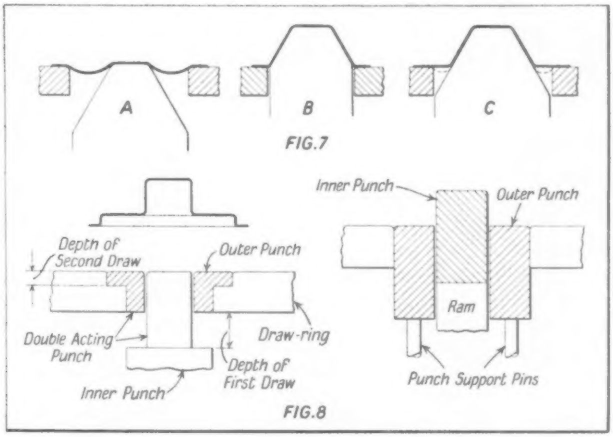


Fig. 7. To Prevent Excessive Overhang of the Blank, as at *A*, the Part Should be Preformed as Indicated at *B*, and then Finished at a Second Drawing Operation *C*. Fig. 8. Two Examples of Double-acting Punches Used to Prevent Rupture of the Metal or Wrinkling Due to Overhang of the Blank

critical. Too much will permit the metal to flow fast and wrinkles may result. On the other hand, too little may result in metal rupture due to excessive drawing action. At the AC works, a lanolin-base Cimcool coolant is employed as a lubricant. It is in paste form and is applied to the blank by the operator with the aid of a brush.

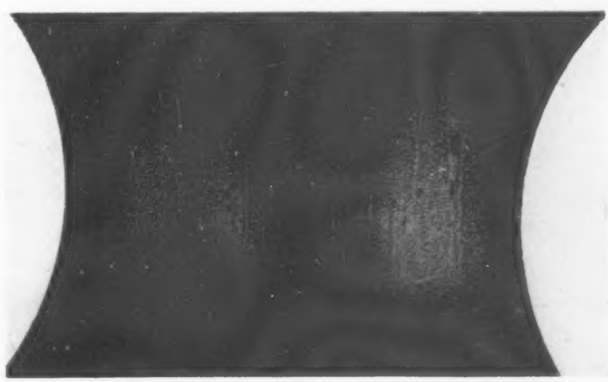
The flexible diaphragm used for Hydroforming is cup-shaped and is made from 2½-in. thick rubber. A replaceable wear sheet, cemented to the lower surface of the diaphragm contacts the blank.

A diaphragm may suffice for 15,000 parts or more. The diaphragm is retained in the dome by seal and snap rings. A roller conveyor is provided at the rear of the press for moving the punch, draw-ring, and draw-ring supports into place. Tools can be changed in an hour or less.

Extrusion of Metal from Fatigue Cracks

Investigations in the Metallurgical Laboratory of the U.S. National Bureau of Standards have shown that, with certain metals, material is extruded from fatigue cracks in surprisingly large amounts. This phenomenon was first revealed by time-lapse motion pictures of a fatigue failure in an aluminium alloy. With the object of collecting samples of extruded material for examination, transparent pressure-sensitive tape was applied to the surface of a torsion fatigue specimen in which fatigue cracks had already been induced. When the specimen was subjected to further stress reversals, small bubbles formed under the tape, as seen in the figure. Further experiments showed that the bubbles appeared as soon as detectable cracks were present. Even when the cracks were so small that they could only be seen with a microscope, the bubbles were sufficiently large to be readily visible to the unaided eye. It is suggested therefore that it may be possible to detect the onset of fatigue cracking in this way.

The tendency to form bubbles was found to be strong with certain aluminium alloys, moderate with cold-rolled mild steel, and very weak with stainless steel. No bubbles were detected on brass or zinc.



Bubbles of Metal which have been Extruded from Fatigue Cracks in a Light Alloy Specimen

News of the Industry

Tyneside

ARMSTRONG WHITWORTH (METAL INDUSTRIES), LTD., Close Works, Gateshead, are well employed on a variety of products. The demand for Closeloy rolls of various types and sizes is fully maintained, and we may note that the necks of these rolls are now being coated with a special lubricant. In this department our attention was drawn to a massive Noble & Lund lathe, equipped with four hydraulically-operated turning rests, which has recently been installed, and to which we hope to make further reference in due course. There is a good call for refined pig-iron and the foundry is producing a variety of spheroidal-graphite iron castings, rolls, marine pistons, cylinder blocks and other components. Other active lines include the Beier steplessly-variable gear reduction units and Eupex flexible couplings, which are now being produced in a larger range of sizes.

Oilfield drilling equipment, built for the Oil Well Supply Co., Ltd., and Kue-Ken jaw and gyratory crushers are in strong request. The former equipment will be exhibited at the Chemical and Petroleum Exhibition, which is to be held at Olympia in June, and one of the crushers will be shown at the Public Works Exhibition in November. A good business is also reported in sub-contract general engineering work and in components for jet propulsion units, also in Roto-finishing machines and railway axle boxes which are produced at the firm's Tyne Street works.

The associated JARROW METAL INDUSTRIES, LTD., Jarrow-on-Tyne, are fully occupied with the production of a variety of steel castings ranging in weight up to 35 tons. These castings include turbine casings, sea valves, propellers, press frames, and gearcases, in carbon, alloy, and manganese steel.

CLARKE, CHAPMAN & CO., LTD., Gateshead, are experiencing a brisk demand for ships' deck machinery, which includes capstans, windlasses, winches and cargo oil pumps. We may note that water-tube boilers, coal pulverizing plants, and conveyors are in hand, for power station use, also tube elements for heat exchangers for the Bradwell atomic power station. Other work includes haulage equipment and conveyors for the National Coal Board. There is a steady demand for searchlights, and mines and industrial lighting equipment, and the same applies to fusion-welded pressure vessels, boiler drums, and fabricated steelwork generally. Extensions in hand include a new research and development building, and recent additions to plant comprise a Richards No. 4 horizontal boring machine and a large Herbert combination turret lathe.

WRIGHT, ANDERSON & CO., LTD., Gateshead, have a big programme of structural steelwork in progress. Orders cover steel-framed buildings for a shipyard and for switchgear manufacturers at Hebburn, also for various schools and technical colleges, a steelworks at West Hartlepool, paper mills at Northfleet, a foundry at Consett, diesel engine and custom sheds for Southern England, and extensions to Hong Kong power station. In addition, we may note that ships' hatches and oil tanks are being made for British Petroleum, Ltd., for various parts of the world. Extensions to the firm's drawing office are in hand, and additions have been made to the erection fleet of mobile and electric derrick cranes.

MICHELL BEARINGS, LTD., Scotswood, Newcastle-on-Tyne, report that there has been no diminution in the heavy demand for Michell bearings for marine applications. For land purposes, we may note orders for hydro-electric plants, waterworks, and colliery and fan installations. Recent additions to machine tool plant include Colchester 7½- and 8½-in. centre lathes, a Dean, Smith & Grace 13-in. swing lathe, and Webster & Bennett 48-in. and 80-in. swing vertical boring and turning mills.

GEORGE ANGUS & CO., LTD., Westgate Road, Newcastle-on-Tyne, are experiencing a well-sustained demand for leather and rubber belting and other rubber products. The Angus Gear Division, at Hebburn, reports a steady call for all types of gear-cutting, particularly from the coal and steel industries. Orders are in hand for Gamax gear reduction units and special gearboxes, and there is a steady business in Peak and Durangus non-metallic gears and raw-hide pinions, also in Norga high-pressure hydraulic gear pumps. The Oil Seal Division, at Wallsend-on-Tyne, is fully occupied on home and overseas orders for a wide range and variety of oil seals. Star tolerance rings, as described in MACHINERY, 92/155—17/1/58, have recently been added to the range of manufactures.

ADAMS POWEL EQUIPMENT, LTD., Team Valley, Gateshead, are well employed on both home and

overseas orders for a variety of automatic packaging machinery, including case sealers and gluers, and conveying and stapling equipment. Among other work in hand may be noted electrical instruments and equipment, gyroscopes, parking meters, and automatic roof tile making machinery.

BREN MANUFACTURING CO. (R. W. CRABTREE & SONS, LTD.), Team Valley, Gateshead, are producing a large number of printing machinery components for the parent company. We may also note that machine tool reconditioning is in progress for the Ministry of Supply and for private firms. Brenco precision-made unbreakable spanners which are also manufactured at these works, are marketed by Macrome, Ltd., Aldersley, Wolverhampton.

QUASI-ARC, LTD., Team Valley, Gateshead (Head Office: Bilston, Staffs.), are busy with the production of a variety of manipulators and welding heads for use with their automatic metal arc-welding processes, which include the Fusarc visible, Unionmelt submerged, and Sigma shielded inert-gas systems. Our attention was drawn to a twin fillet welding gantry which has been developed for welding stiffeners on to bulkhead panels in such a way that the fillet welds on either side of the stiffener are deposited simultaneously, by the Unionmelt automatic welding process. Considerable additions have been made to the machine tool equipment at these works and among the machines noted were a Kendall & Gent CVM45 vertical milling machine, a Cincinnati No. 3 universal horizontal milling machine with overarm attachment, Town 6-ft. and Archdale 5-ft. radial drilling machines, a Ward No. 7 capstan lathe, an Ormerod 12-in. stroke slotting machine, a Clifton & Baird cold sawing machine, a Planers (Huddersfield), Ltd., 20- by 5- by 5-ft. openside planing machine, and a B.O.C. automatic flame-cutting machine.

C. A. PARSONS & CO., LTD., Heaton, Newcastle-on-Tyne, 6, announce that they are to begin development of a 109-acre factory site at Longbenton, in Northumberland. The first stage will involve the building of workshops for light engineering work at a cost of £100,000. Sir Claude Gibb, chairman of the firm, has stated that despite the very large sums spent on developments at their Heaton and Walkergate Works, Newcastle, their facilities are still inadequate in relation to present needs.

Increased pressure on space has resulted from rapid growth in the capacity of generating plant. About 10 years ago, the average size of turbo-generators ordered from the company was 22,000 kW. and the largest was 66,000 kW. Today the average size is 150,000 kW. and the largest 300,000 kW. Sir Claude added that his firm had submitted a tender for what would be the largest turbo-generator in the world at 550,000 kW. Simultaneously with the first stage of the Longbenton scheme, work is to begin on a £250,000 heavy shop at Walkergate.

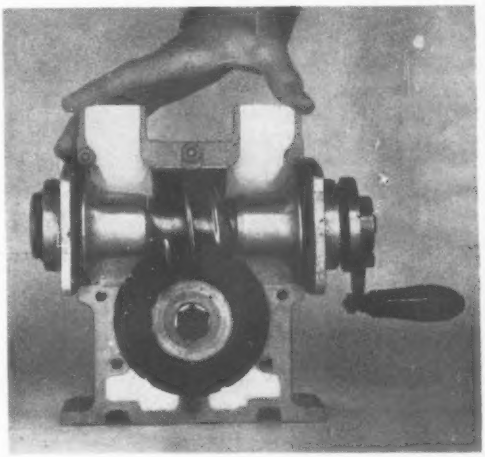
Another project will involve the erection of research laboratories on a site at the Fossway, Newcastle, at a cost of £1,000,000. The buildings will be used for research and development work in the nuclear field concerned, for example, with metallurgy, heat transfer, and aerodynamics.

H. B.

The Goodyear Pump

Goodyear Pumps, Ltd., Camborne, Cornwall, a member company of the Holman group, have introduced a new self-priming pump which incorporates a form of Archimedean screw. It will be recalled that with the Archimedean screw, liquid is carried through a cylinder by a rotating shaft with a deep helical thread, which is a close fit in the bore.

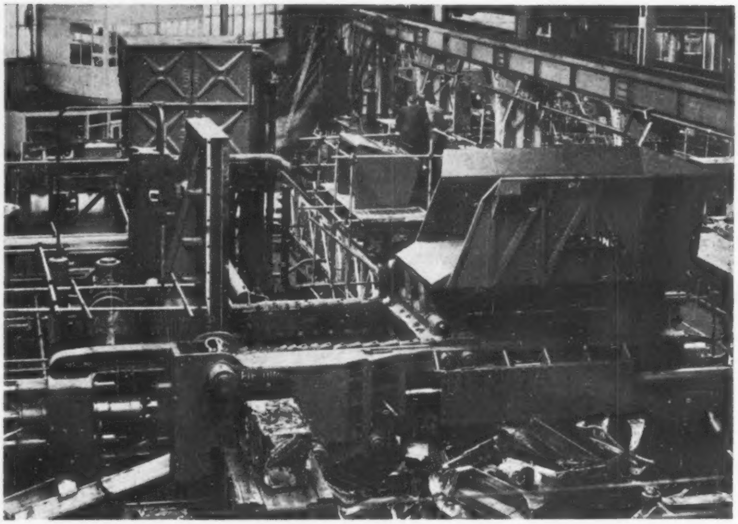
In the Goodyear pump, the threaded portion of the shaft rotates in a cylindrical rubber housing and engages with radial slots in a circular rubber disc. The arrangement of the worm and disc is seen in the accompanying illustration, which shows a cut-away, demonstration unit. This disc serves to prevent any reverse flow of liquid so that a positive pumping action, free from pulsa-



Goodyear Pump Cut Away for Demonstration Purposes

tion, is obtained. The substance to be pumped may range from a mixture of water and air to extra heavy oil, for example, and acts as a lubricant between the metal and rubber surfaces. It enters the pump at the top by way of one port and is then expelled upwards through the other. Running in taper roller bearings protected by lip seals, the worm shaft can be rotated in either direction, so that either port may serve for intake or delivery. In addition to the lip seals, face seals are provided, and there are chambers, vented to atmosphere, between the seals and the bearings, so that, in the event of leakage, pressure is not exerted on the bearings. When the pump is to be used in a pipe line with a shut-down valve on the delivery side, a pressure relief valve can be supplied. If the shut-down valve is inadvertently operated, liquid is re-circulated to the suction side of the pump, so that the equipment is protected from overload.

Available in three sizes, with connections for 1¼-, 1½-, and 2½-in. diameter pipes, the pump can be supplied with a body of light alloy, Meehanite, or bronze, and it is expected that a body with a nickel-plated finish will be available shortly. Outputs from 4½ to 167 gal. of water per min., at delivery pressures up to 85 lb. per sq. in. (or 200 ft. head) are obtainable. Prime movers from ⅛ to 16 b.h.p. are required, and shaft speeds normally range from 750 to 3,000 r.p.m.



Large Capacity Fielding Triple-action Scrap Baler

Large Fielding Scrap Baler

The hydraulically-operated triple-action scrap baler shown in the figure has recently been built by Fielding & Platt, Ltd., Gloucester, for Colvilles, Ltd.

It will handle scrap at the rate of about 20 tons per hour, and has a capacity for producing bales of 24 by 22⅛ in. cross section, and up to 56 in. long, with a maximum weight of about 1 ton. A hopper, of 300 cu. ft. capacity, mounted on the bed, is tilted hydraulically for loading scrap into the 9-ft. long by 7-ft. wide and 3-ft. deep baling box. Initial compression of the scrap is then carried out, under a load of 270 tons, by a massive hinged cover, which is swung to the closed position by a vertical hydraulic cylinder and a pair of links. Reversible shear blades are attached to the sides and end of the cover, and mating crocodile blades are secured to the top of the baling box, so that any overhanging pieces of scrap are cut off during the downward movement of the cover.

Next, a load of 360 tons is applied to the scrap by a slide which extends for the width of the baling box, and is moved lengthwise for a maximum distance of 7 ft. 1½ in. by three hydraulic cylinders. Finally, the scrap is compressed, under a load of 480 tons, by a rectangular-section ram which passes through an opening in one side of the baling box, and is operated by a hydraulic cylinder with a stroke of 11 ft. 3 in. A sliding door at the opposite side of the baling box is then opened, by another hydraulic cylinder, and the rectangular-section ram is again advanced, to discharge the bale.

Pressure fluid is delivered to the hydraulic cylinders by two low-pressure and two high-pressure reciprocating pumps of the Fielding H.3 type, which are driven by separate motors. Thruster-operated mitre-seat control valves are incorporated in the hydraulic system, which provides a maximum working pressure of 3,000 lb. per sq. in. The pump motors, and the various motions

of the scrap baler, are controlled from a desk which is mounted in an elevated position. Each stage of the baling cycle is started by turning a large-diameter handwheel, and completion of the various stages is indicated by means of coloured signal lamps.

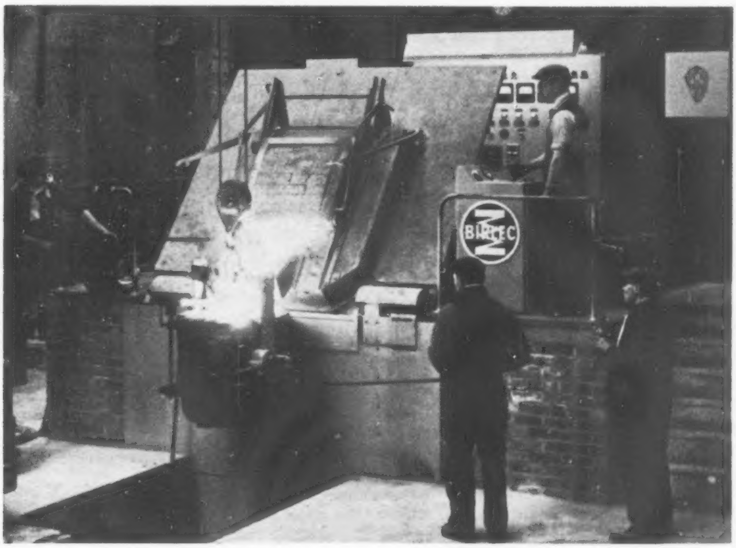
The baler occupies a floor space of 39 ft. 6 in. by 52 ft. 6 in., and the overall height, with the hopper in the tilted position, is 20 ft. 6 in.

Mains Frequency Steel Furnace

Inca Steel Co., Ltd., Magnum Works, Sheffield, 4, have recently put into operation what is stated to be the first mains-frequency coreless induction furnace to be employed for the production of alloy and high-speed steels in this country. This furnace, shown in the accompanying illustration, with pouring in progress, was built and installed by Birlec, Ltd., Tyburn Road, Erdington, Birmingham. It has a capacity of 1½ tons and the power input of 450 kW. enables a maximum output of ½ ton of high-speed steel ingots per hour to be obtained. The furnace is charged with selected scrap, and a heel of metal is retained from each heat as the basis for the following charge. Tilting is effected by hydraulic rams supplied with pressure oil from a self-contained pump unit, and a bottom-pouring ladle is employed for transferring the metal to the ingot moulds.

The furnace has been developed by Birlec, Ltd., under agreement with the German firm Otto Junker G.m.b.H., Lammersdorf, who have made considerable progress in the application of such furnaces to the melting of high-grade alloy and high-speed steels. Birlec mains-frequency coreless induction furnaces are, of course, already widely used in non-ferrous and iron foundries.

The performance of the new installation is stated to be very satisfactory, and no troubles have been experienced with detrimental inclusions in the steel due to turbulence of the molten metal, which is a characteristic of this type of furnace.



Pouring the Birlec 1½-ton Mains Frequency Coreless Induction Furnace Recently Installed at the Works of Inca Steel Co., Ltd., Sheffield, for the Production of High Grade Alloy Steels

Trade Publications

DALLOW LAMBERT & CO., LTD., Thurmaston, Leicester. Effectively illustrated brochure (No. 55) concerned with the company's range of dust control equipment. Sections are devoted to Dustmaster and Drytex unit dust collectors; Drytube filters; wet dedusters; and plant installations.

BRIBOND, LTD., Burgess Hill, Sussex. Booklet of 40 pages showing numerous examples of signs, for industrial and general purposes. It is claimed that these signs, which are made by a special process, are practically indestructible. The printed matter or photostat is protected by a layer of transparent plastics.

GENERAL SIGNAL & TIME SYSTEMS, LTD., 73 Great Peter Street, London, S.W.1. Folder illustrating various products of the company including time recorders, job costers, programme instruments, broadcasting equipment and calendar clocks.

SQUARE D, LTD., 100 Aldersgate Street, London, E.C.1. — Catalogue sheet covering the new Class 9050 narrow base pneumatic timing relays which have been designed primarily for the machine tool industry. They can be supplied for both A.C. and D.C. operation.

WILLIAMS & DICKINSON (LONDON), LTD., 27 John Adam Street, London, W.C.2.—Leaflets describing the Talisman swarf truck and Talisman bar racks which have recently been introduced by the company. The racks can be supplied in single- and double-sided, and pigeon-hole forms.

Industrial Notes

THE PROFESSIONAL ENGINEERS APPOINTMENTS BUREAU has moved to 39 Victoria Street, London, S.W.1. The telephone number (Abbey 1737) has not been changed.

THE SPEEDWELL GEAR CASE CO., LTD., Tame Road, Witton, Birmingham, 6, inform us that the address of their London office is now 29 Palace Chambers, Bridge Street, S.W.1.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby, report that the two millionth electric motor manufactured at their works at Blackheath, Birmingham, recently came off the production line.

PEARSON PANKE, LTD., 1-3 Hale Grove Gardens, London, N.W.7, inform us that they have available a 16-mm. sound film in which Schuler transfer presses are fully described and illustrated. The film runs for approximately 30 min.

RODGERS BROS., LTD., Blackwell Street, Brixton Road, London, S.W.9, inform us that they have installed a new Heidenreich & Harbeck type 26H hydraulic bevel gear generator, with a capacity of approximately 9 in. diameter (24 to 4 D.P.).

JANUARY STEEL AND PIG-IRON PRODUCTION.—Steel output in January averaged 407,100 tons a week, compared with 415,900 tons in January, 1957. The Iron and Steel Board attribute the decline to a slabbing mill breakdown at one of the leading works. Pig-iron production in January averaged 271,000 tons a week, compared with 256,900 tons in January, 1957.

HEENAN & FROUDE, LTD., Worcester, inform us that they have received a further order from British Ropes, Ltd., for Heenan Dynamatic eddy type couplings. These couplings will be employed under electronic control in wire drawing machine drives, and will serve to maintain constant maximum linear speed and constant tension while the diameters of the coils of material vary progressively.

THE SCIENTIFIC INSTRUMENT MANUFACTURERS' ASSOCIATION OF GREAT BRITAIN, 20 Queen Anne Street, London, W.1, is arranging a Canadian tour of senior executives of leading British instrument manufacturers. The object of this tour is to extend the goodwill engendered by the visit of the Canadian Trade Mission to this country last December and to investigate the possibilities of increasing trade instruments between the United Kingdom and Canada.

CONTACTOR SWITCHGEAR, LTD., Moorfield Road, Upper Villiers Street, Wolverhampton, recently celebrated the 21st anniversary of the foundation of the business. In this connection a fully-illustrated 20-page brochure has been issued in which the growth of the business is briefly outlined. Typical applications of products are shown, for example, for thermal and nuclear power stations, chemical plant, steelworks, non-ferrous rolling mills, heat treatment plant, and machine tool control.

SCIENTIFIC INSTRUMENTS LIABLE TO KEY INDUSTRY DUTY.—The Board of Trade have made the Key Industry Duty (List No. 5—Scientific Instruments) (Amendment) Order 1958, and it has been published as Statutory Instruments, 1958, No. 200. This order adds the following to the list liable to Key Industry Duty: instruments for performing bending, compression, fatigue, impact, tensile and torsion tests. Copies of the Order (price 2d.—by post 4d.) may be obtained from H.M. Stationery Office, Kingsway, London, W.C.2, and branches.

ENGLISH NUMBERING MACHINES, LTD., 25 Queensway, Enfield, Middlesex, recently celebrated the 21st anniversary of the incorporation of the company. They state that they are now the largest manufacturers of hand-operated numbering and dating machines in the world, also leading producers of precision counting devices and printer's numbering boxes. In connection with the anniversary celebrations a long service dinner was held, at which presentations were made to eleven employees who have been with the company since 1937.

ELECTRICAL REMOTE CONTROL CO., LTD., have moved to a new factory at Bush Fair, Tye Green, Harlow New Town, Essex. The factory is built on a ½-acre site and is the first on the new industrial estate at Tye Green. This move was necessitated by the increasing demand for the company's products, which include electrical timing equipment, relays, low voltage soldering irons, and special-purpose automatic electrical control equipment. Equipment & Services, Ltd., whose activities include an electrical wholesale business and the distribution of drawing office supplies, will also be accommodated in the new building.

CONTROL OF QUALITY—A TOOL OF MANAGEMENT will be the subject of a conference organized by the Guildford and District Productivity Association in conjunction with the Institution of Engineering Inspection and the R.A.E. Technical College, which will be held in the Farnborough Technical College, Farnborough, Hampshire, on February 26. Subjects of papers will include: Some management aspects of control of quality; Can work study be applied to inspection?; Cost aspects of quality control; and Planning and manning for control of quality. Those wishing to attend should apply to Mr. F. Bloor, M.I.Mech.E., M.I.Prod.E., vice-principal, the Technical College, Farnborough.

Stanhope Machine Tool Agencies

Stanhope Machine Tools, Ltd., 5-17 Haverstock Hill, Chalk Farm, London, N.W.3, are sole representatives in Great Britain and Northern Ireland for the following:—

G.S.P.—a wide range of machine tools including high speed shapers; planing and plano-milling machines; radial, universal, vertical, and multi-spindle drilling machines; an automatic, punched tape control, universal jig boring, drilling, tapping and milling machine; high-speed surface and internal grinders; automatic high speed production gear hobbers; and special-purpose machines.

Rouchaud & Lamassiaude—automatic cycle production, universal, and lever-operated milling machines; profile milling equipment; vertical milling machines with rotary work tables; and automatic dividing heads.

Vilar—" super universal " grinding machines for surface, internal and external grinding, also for form, radius, and compound and relief angle grinding of shell and end milling cutters, hobs, reamers, thread chasers, broaches drills, and boring tools.

Ainjest—attachment for high-speed, internal and external production screwcutting on centre lathes.

Gambin—universal precision milling machines with bi-rotary sliding heads; Gambin-Herlicq automatic cycle copy milling machines; universal slotting and rack cutting attachments; sensitive high-speed drilling and milling attachments; and universal dividing heads.

Vernet—universal punching and shearing machines; notching machines; quick action punching machines; bar cropping machines; and vertical and horizontal bending rolls.

Huard—automatic, semi-automatic, and hand-operated high-speed abrasive cutting-off machines; horizontal disc grinders; polishing and buffing machines; swing-frame grinding and fettling and cutting-off machines; pedestal grinders; and twist drill grinders.

Standards Engineers Conference

This year's conference of engineers responsible for standards matters will be held on May 21 at the Connaught Rooms, London. It will be opened by Mr. F. J. Erroll, Parliamentary Secretary to the Board of Trade, and Mr. H. Stafford, who is chairman of the Standards Committee of the Institution of Production Engineers, will preside. The conference is organized by the I.Prod.E. and the British Standards Institution.

One of the main topics will be a discussion on the inch-metric problem from the standpoint of Britain's position as an exporter to both inch and metric countries. The agenda will also include a review of day-to-day problems facing standards engineers.

Those concerned with the application of standards in industry who would like to attend the conference should write to The Secretariat, I.Prod.E./B.S.I. Committee, British Standards House, 2 Park Street, London, W.1.

The Extending Field for Ultrasonics

(*Continued from page* 411)

some heating takes place, the metals do not approach their melting points during the operation. The frequency of vibration employed depends on the thickness of the metal to be welded, lower frequencies being suitable for greater thicknesses. Welding head capacity determines the maximum thickness that can be welded, and with existing equipment the limit for aluminium alloy, for instance, is about 0·08 in. Very thin material can be welded successfully and it is also possible to weld foil to plate. Another advantage of the process is the ability to weld dissimilar metals, such as aluminium to copper and molybdenum to nickel.

These few examples will serve to drawn attention to the versatility of high-frequency low-amplitude vibration, and it is reasonable to suppose that with further investigation it will find other valuable applications.

Obituary

Mr. W. T. Bell, O.B.E., J.P., M.I.Mech.E., who died recently, at the age of 90, was chairman and joint managing director of Robey & Co., Ltd., Globe Works, Lincoln. He had been actively engaged with the company for 73 years, up to the day of his death. Mr. Bell was apprenticed to the company in 1885, appointed secretary in 1893, director in 1905, managing director in 1914, and chairman and managing director in 1922.

Mr. A. E. Hukins, founder and former managing director of E.N.V. Engineering Co., Ltd., Hythe Road, Willesden, London, N.W.10, died on February 2. He will be remembered for his pioneering work in connection with the production of E.N.V. engines which powered many of the early experimental aircraft before the first world war. Later he took a prominent part in building up the precision gear industry in this country. In particular he was closely associated with the introduction and manufacture of spiral bevel gears.

Correction

In Machinery, 92/286—31/1/58 it was stated that W. O. Bullock & Sons, Ltd., had been appointed agents for Crawford Collets, Ltd., but the address of the former company was given incorrectly. This address is 126 Rodbourne Road, Swindon, Wilts. (telephone number, Swindon 6331). •

Personal

Mr. N. G. P. Boswood, secretary of the George Cohen 600 Group, Ltd., has been appointed a director of The Colchester Lathe Co., Ltd., Hythe, Colchester.

Mr. J. S. Exley has been appointed manager of marketing of the Conveyor and Transmission Belting Division of BTR Industries, Ltd., Herga House, Vincent Square, London, S.W.1.

Mr. P. W. Howard, managing director of BTR Industries, Ltd., Herga House, Vincent Square, London, S.W.1, has, in addition, been appointed deputy chairman of the board.

Sir Ashley Ward received the knighthood announced in the New Year Honours List on February 11. President of Thos. W. Ward, Ltd., Albion Works, Sheffield, Sir Ashley is also well known for the work that he has done for education. He received the honorary degree of LL.D. from Sheffield University in 1955.

Sir Ashley Ward

Mr. D. Brook

Mr. David Brook, son of the chairman of directors, Mr. Frank V. Brook, has recently been co-opted to the board of directors of Brook Motors, Ltd., Empress Works, Huddersfield. Educated at Oundle, he has been with the company for six years and has occupied an executive position since his return from service in the Royal Electrical and Mechanical Engineers, where he held a commissioned rank.

Dr. Brian Baldwin has been appointed assistant chief metallurgist of the Steel Division of The Steel Company of Wales, Ltd., Abbey Works, Port Talbot. He joined the company last year as research metallurgist, blast furnaces, and had previously been engaged on research into iron making at the London laboratories of the British Iron and Steel Research Association.

Mr. E. G. James, B.Sc., A.M.I.E.E., retired recently after 39 years' service with the British Thomson-Houston Co., Ltd., Rugby. He spent most of his career in the Industrial Engineering Department but for the past two years has been personal assistant to Mr. G. S. C. Lucas, director and chief electrical engineer.

Mr. R. Price has been appointed sales manager of Birfield Tools & Designs, Ltd., Bodmin Road, Coventry, and will be responsible for the sales of both the toolmaking and machine tool divisions of the organization.

Mr. George C. Fairbanks, M.I.Prod.E., a deputy general manager of Elliott Brothers (London), Ltd., Lewisham, London, S.E.13, has been appointed a director of the company.

Scrap Metals

†London.—‡Prices per ton for non-ferrous scrap metals free from iron are as follows:—clean copper wire, untinned and free from lead and solder, £127; clean heavy copper, untinned and free from lead and solder, £120; second grade copper wire, £115; clean light copper £112; braziery copper, £104; gunmetal, £112; brass mixed, £72; lead, net, £57; zinc, £29; cast aluminium, £89; old rolled aluminium, £122; battery lead, £30; unsweated brass radiators, £60; hollow pewter, £495; black pewter, £365.

Midlands.—There are encouraging signs of improvement in the demand for some grades of ferrous scrap. Rather more loading permit labels are available for heavy steel, and odd wagon loads of No. 8 light iron are being called for by blast furnaces. Chipped turnings are available in greater quantities than can be immediately placed, but, in general, a fair tonnage can be moved each week to markets outside the Black Country area. Difficulty in disposing of bushy turnings is still very real and many merchants are only offering a " token " price. In some instances, indeed, they will only move such turnings on a " free of charge " basis.

Trading with foundries in short steel and cast iron scrap is reasonably good, but most of the sheared steel scrap can only be placed against orders for No. 1 and/or 2 short heavy material. Few markets are open for 0.04 max. sulphur and phosphorus short heavy steel scrap.

Allocations for hydraulically compressed scrap are insufficient to absorb the large tonnages which are being produced, and stocks of No. 5 heavy bundles and destructor bundles at merchants' yards are steadily increasing.

Offers for parcels of high-speed steel scrap have improved slightly.

Current maximum control prices, delivered consumers' works, are now: *Heavy steel No. 1, 217s. 6d.; *heavy steel No. 2, 196s.; *heavy steel No. 4, 207s. 6d.; *heavy steel No. 5, 195s. 6d.; light iron No. 8, 149s.; short turnings No. 9 (free from alloy), 167s. 3d.; light steel No. 11, 164s. 3d.; bushy turnings, 117s.; short alloy turnings, 160s. 9d.; short steel No. 2, 233s. 3d.; machinery cast, 233s.

Prices may be increased up to 2s. 6d. per ton according to quantities tendered over a given period.

* For use by Round Oak Steelworks, Brierley Hill, increase by 1s. 6d. per ton.
† George Cohen, Sons & Co., Ltd., Commercial Road, E.14.
‡ Subject to market fluctuations.

Coming Events

INSTITUTION OF PRODUCTION ENGINEERS.—*Shrewsbury Section.* February 26, at 7.30 p.m., at the Walker Technical College, Oakengates, Shrewsbury; lecture on "Shell Moulding," by G. Hannaford and T. Lawrence. *Derby Section.* February 28, at 7 p.m., at the College of Art, Derby; lecture on "Nuclear Power and the Production Engineer," by I. Munro, B.Sc. *Rochester Graduate Section.* February 27, at 7.30 p.m., at the Sun Hotel, Chatham; lecture on "Broaching versus Milling," by A. R. Hambidge. *Cardiff Section.* February 28, at 7 p.m., at the South Wales Institute of Engineers, Park Place, Cardiff; lecture, illustrated by a film, on "The Use of Time-lapse Photography in Work Study," by A. G. Northcott.

MANCHESTER ASSOCIATION OF ENGINEERS.—February 28, at 6.45 p.m., at the Engineers' Club, Albert Square, Manchester, 2; paper on "Brushless Variable Speed Induction Motors," by Prof. F. C. Williams, D.Sc., D.Phil.

INSTITUTION OF MECHANICAL ENGINEERS.—*North Western Branch. Industrial Administration and Engineering Production Group.* February 27, at 6.45 p.m., at the Engineers' Club, Albert Square, Manchester, 2; paper on "Planned Maintenance of Plant," by W. Jones.

Machine Tool Share Market

Stock markets were dull and unsettled, with mainly quiet trading, during the past week, and prices drifted to lower levels in most sections.

The gilt-edged market, however, after early irregularity, became steady to firm, and British Funds, together with other high grade investment stocks, finished on a good note.

Commercial and industrial share markets were depressed and displayed an easier trend for the most part. Generally brighter conditions developed near the close, however, under the influence of favourable company statements.

Among machine tool issues, Edgar Allen lost 6d. at 28s. 6d.; Asquith Machine Tool, 7½d. at 20s. 7½d.; Birmingham Small Arms, 1s. at 25s.; British Oxygen, 1s. at 29s.; Kayser Ellison, 1s. at 53s.; Thos. W. Ward, 1s. at 72s. 6d.; Chas. Churchill, 1½d. at 4s. 7½d.; John Harper, 1½d. at 14s.; John Shaw & Sons (Wolverhampton), 1½d. at 12s. 3d.; Geo Cohen, 3d. at 10s. 9d.; John Holroyd "B," 3d. at 9s. 9d.; and Kitchen & Wade, 3d. at 10s. 6d. On the other hand, F. Pratt improved 3d. to 20s.

GEORGE COHEN 600 GROUP, LTD.—Interim dividend of 4½ per cent.

COMPANY		Demon.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/–	9d.
Armstrong, Stevens & Son, Ltd.	Ord.	5/-	7/9
Allen (Edgar) & Co., Ltd.	Ord.	£1	28/6
" "	5% Prf.	£1	14/6*
Arnott & Harrison, Ltd.	Ord.	4/–	14/3
Asquith Machine Tool Corp., Ltd.	Ord.	5/–	20/7½
" " "	6% Cum. Prf.	£1	17/9
Birmingham Small Arms Co., Ltd.	Ord.	£1	25/-
" " "	5% Cum. "A" Prf.	£1	15/6
" " "	6% Cum. "B" Prf.	£1	17/6
" " "	4% 1st Mort. Deb.	Stk.	86/–
British Oxygen Co., Ltd.	Ord.	£1	29/–
" " "	6½% Cum. Prf.	£1	21/6
Brooke Tool Manufacturing Co., Ltd	Ord.	5/–	5/6
Broom & Wade, Ltd.	Ord.	5/–	9/9xd
" "	6% Cum. Prf.	£1	17/9
Brown (David) Corporation, Ltd.	5½% Cum. Prf.	£1	14/4½
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/6
Butler Machine Tool Co., Ltd.	Ord.	5/–	6/6
" " "	5% Cum. Prf.	£1	13/9
C.V.A. Jigs, Moulds & Tools, Ltd.	5½% Red. Cum. Prf.	£1	13/9
Churchill (Charles) & Co., Ltd.	Ord.	2/–	4/7½
" " "	6% Cum. Prf.	£1	26/3†
Churchill Machine Tool Co., Ltd.	Ord.	5/–	17/4½
" " "	6% Cum. Prf.	£1	18/9
Clarkson (Engrs.), Ltd.	Ord.	5/–	10/6
Cohen (George), Son & Co., Ltd.	Ord.	5/–	10/9
" " "	4½% Cum. Prf.	£1	14/3
Coventry Gauge & Tool Co., Ltd.	Ord.	10/–	14/6
" " "	5% Cum. Red. Prf.	£1	16/3
Coventry Machine Tool Works, Ltd.	Ord.	4/–	8/6
Craven Bros. (Manchester), Ltd.	Ord.	5/–	5/9
Elliott (B.) & Co., Ltd.	Ord.	1/–	3/–
" "	4½% Red. Cum. Prf.	£1	13/9
Export Tool & Case Hardening Co., Ltd.	Ord.	2/–	1/9
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	12/-
Greenwood & Batley, Ltd.	Ord.	£1	46/10½

COMPANY		Demon.	Middle Price
Harper (John) & Co., Ltd.	Ord.	5/–	14/–
" "	4½% Red. Cum. Prf.	£1	12/9
Herbert (Alfred), Ltd.	Ord.	£1	60/–
Holroyd (John) & Co., Ltd.	"A" Ord.	5/–	11/–
" " "	"B" Ord.	5/–	9/9
Jones (A. A.) & Shipman, Ltd.	Ord.	5/–	21/3
" " "	7% Cum. Prf.	5/–	5/-
Kayser, Ellison & Co., Ltd.	Ord.	£1	53/–
" " "	6% Cum. Prf.	£1	18/3
Kendall & Gent, Ltd.	Ord.	5/–	7/9
Kerry's (Gt. Britain), Ltd.	Ord.	5/–	5/9
Kitchen & Wade, Ltd.	Ord.	4/–	10/6
Martin Bros. (Machinery), Ltd.	Ord.	2/–	2/4½
Massey, B. & S., Ltd.	Ord.	5/–	7/3
Modern Engineering Machine Tools, Ltd.	Ord.	5/–	11/–
Newall Engineering Co., Ltd.	Ord.	2/–	5/–
Newman Industries, Ltd.	Ord.	2/–	2/9
" "	6% Prf. Ord.	5/–	5/6
Noble & Lund, Ltd.	Ord.	2/–	4/9
Osborn (Samuel) & Co., Ltd.	Ord.	5/–	17/–
" " "	5½% Cum. Prf.	£1	25/–
Pratt (F.) & Co., Ltd.	Ord.	5/–	20/–
Scottish MachineTool Corporation, Ltd.	Ord.	4/-	5/3
Shardlow (Ambrose & Co., Ltd.	Ord.	£1	35/-
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/–	12/3
Sheffield Twist Drill & Steel Co., Ltd	Ord.	4/–	35/–
" " " "	5% Cum. Prf.	£1	15/–
Stedall & Co., Ltd.	Ord.	5/–	4/9
Tap & Die Corporation, Ltd.	Ord.	5/–	7/9
" " "	4½% Deb. 1961-1977	Stk.	82/-
Wadkin, Ltd.	Ord.	10/–	19/6
Ward (Thos. W.), Ltd.	Ord.	£1	72/6
" "	5% Cum. 1st Prf.	£1	15/6
" "	5% Cum. 2nd Prf.	£1	24/3
Willson Lathes, Ltd.	Ord.	1/–	2/4½

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. † Birmingham price.

BRITISH MACHINE TOOL

Exports of New Machine Tools

Countries	Vertical Boring Machines		Other Boring Machines		Drilling Machines		Grinding, Lapping and Honing Machines		Automatic Lathes		Capstan and Turret Lathes		Other Lathes		Screwing Machines	
	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £
Commonwealth																
South Africa	134 (7)	3,601	14 (2)	703	405 (28)	8,511	409 (65)	14,570	49 (1)	1,184	448 (10)	18,347	883 (18)	28,720	3 (1)	154
India	320 (2)	11,257	1,117 (6)	27,086	1,000 (16)	23,478	625 (29)	20,140	98 (1)	2,041	890 (11)	26,652	372 (23)	10,895	—	—
Pakistan	—	—	2 (1)	257	41 (5)	1,107	12 (2)	552	—	—	—	—	330 (4)	7,067	—	—
Australia	—	—	—	—	239 (14)	7,661	1,155 (31)	39,145	447 (7)	22,336	399 (14)	15,953	575 (51)	18,938	123 (7)	8,720
New Zealand	—	—	31 (2)	649	114 (10)	2,891	161 (81)	5,327	37 (1)	1,008	—	—	602 (22)	16,178	2 (1)	92
Canada	386 (2)	10,828	—	—	1,007 (48)	21,601	320 (12)	11,846	171 (2)	5,481	841 (15)	30,705	2,267 (127)	71,315	44 (1)	1,870
Miscellaneous	176 (2)	4,636	17 (3)	990	1,040 (110)	20,688	72 (60)	4,426	—	—	124 (3)	6,369	1,127 (50)	37,704	14 (2)	466
Foreign																
Soviet Union	—	—	—	—	—	—	2,211 (4)	81,609	—	—	—	—	—	—	—	—
Sweden	120 (1)	3,290	—	—	209 (4)	6,691	124 (23)	4,416	88 (2)	4,898	397 (8)	16,493	24 (2)	833	—	—
Norway	—	—	—	—	79 (7)	1,796	1 (1)	36	—	—	—	—	9 (5)	352	—	—
Denmark	—	—	—	—	162 (3)	2,854	16 (1)	567	—	—	23 (2)	1,689	30 (2)	560	—	—
Western Germany	—	—	—	—	—	—	35 (4)	4,380	121 (1)	5,595	—	—	128 (3)	5,957	—	—
Netherlands	—	—	—	—	61 (9)	1,757	4 (7)	289	84 (1)	2,599	77 (5)	3,547	103 (4)	3,769	—	—
Belgium	125 (1)	3,176	—	—	180 (20)	3,986	35 (4)	1,258	—	—	—	—	42 (3)	2,094	—	—
France	63 (1)	4,894	68 (2)	4,205	157 (3)	4,785	899 (14)	38,060	43 (1)	2,098	479 (9)	21,989	18 (1)	1,174	—	—
Switzerland	—	—	2 (6)	343	182 (12)	4,287	116 (4)	4,313	—	—	253 (2)	9,291	117 (9)	4,395	39 (2)	3,231
Spain	80 (1)	5,186	—	—	404 (4)	19,135	101 (1)	4,721	127 (3)	8,228	117 (2)	7,879	—	—	20 (1)	2,757
Italy	—	—	—	—	—	—	22 (3)	2,438	64 (1)	4,607	—	—	—	—	—	—
U.S. America	—	—	—	—	1,189 (17)	23,846	196 (11)	14,373	34 (1)	1,773	233 (6)	9,089	1,676 (67)	44,674	—	—
Miscellaneous	5 (1)	143	251 (2)	9,511	436 (56)	9,817	513 (53)	21,611	248 (2)	15,749	138 (5)	6,363	1,592 (76)	44,019	—	—
Total	1,409 (18)	47,011	1,502 (24)	43,744	6,905 (366)	164,891	7,027 (410)	274,077	1,611 (24)	77,597	4,419 (92)	174,366	9,895 (467)	298,644	255 (15)	17,290
Amendments to previous accounts																
Commonwealth	—	—	—	—	−318 (−2)	−7,441	+75 (+2)	+1,953	+76 (+3)	+3,902	—	—	−57 (−16)	−2,216	—	—
Foreign	—	—	—	—	—	—	+59 (—)	—	+49 (+1)	+1,907	—	—	−6 (—)	—	—	—

Total exports of reconditioned machine tools: Quantity No., 96; weight, 2,602 cwt.; value, £28,461.
Total exports of imported machine tools: Quantity No., 16; weight, 1,390 cwt.; value, £57,407.

Imports of New Machine Tools

Country of Origin	Boring and Broaching Machines		Drilling Machines		Gear-cutting Machines		Grinding, Lapping and Honing Machines		Automatic Lathes	
	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £
Western Germany	1,488 (16)	54,008	1,184 (13)	18,606	1,116 (15)	73,366	2,699 (56)	149,553	2,812 (49)	173,131
Belgium	349 (1)	12,384	—	—	—	—	1 (1)	166	—	—
France	430 (1)	17,271	1 (1)	135	—	—	—	—	—	—
Switzerland	609 (10)	50,432	25 (3)	1,785	26 (2)	3,015	180 (10)	17,775	494 (17)	41,169
U.S. America	132 (1)	12,023	(2)	390	210 (23)	20,996	509 (8)	62,868	1,427 (5)	85,391
Miscellaneous	3,193 (15)	63,930	406 (9)	5,788	78 (2)	3,073	544 (16)	28,008	328 (4)	17,308
Total	6,201 (44)	210,048	1,616 (28)	26,704	1,430 (42)	100,450	3,933 (91)	258,370	5,061 (75)	316,999
Amendments to previous accounts										
Western Germany	—	—	—	+85	—	—	—	—	—	—
France	—	—	—	—	—	—	—	—	—	+20
Switzerland	—	—	—	—	—	—	—	—	— (+1)	—
U.S. America	—	—	+321(+1)	+26,191	—	—	—	—	—	—
Miscellaneous	—	—	—	—	—	—	—	—	—	—

Total imports of reconditioned machine tools: Quantity No., 18; weight, 928 cwt.; value, £41,713.

IMPORTS AND EXPORTS (Classified)

and Parts during November, 1957

Threading Machines		Milling Machines		Gear-cutting Machines		Planing, Shaping and Slotting Machines		Presses		Sheet Metal-working Machines		Sawing Machines		Other Machines		Machine Tool Parts*		Total	
Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt.	Value £	Quantity. Cwt. and No.	Value £
10 (1)	316	126 (5)	5,706	—	—	181 (6)	3,261	808 (22)	16,821	138 (32)	1,747	18 (2)	405	1,040 (39)	29,608	507	13,921	5,173 (239)	147,575
22 (1)	539	430 (11)	18,713	—	—	58 (1)	446	322 (15)	11,728	291 (15)	5,801	—	—	1,083 (37)	31,459	362	55,264	6,990 (168)	245,499
—	—	—	—	—	—	68 (3)	1,550	—	—	—	—	—	—	30 (5)	1,466	11	731	494 (20)	12,730
29 (2)	878	523 (15)	24,592	—	—	463 (5)	8,365	3,556 (11)	58,466	156 (50)	5,391	78 (4)	2,374	3,199 (27)	50,990	746	40,197	11,688 (238)	304,006
—	—	238 (6)	9,425	—	—	43 (2)	781	164 (2)	1,727	70 (86)	1,240	60 (9)	1,334	87 (76)	1,616	138	3,876	1,747 (298)	46,144
—	—	527 (17)	16,642	—	—	178 (5)	3,849	393 (5)	5,554	13 (10)	213	17 (1)	257	516 (19)	10,598	3,564	73,187	10,244 (264)	263,946
14 (1)	578	107 (5)	5,405	—	—	422 (4)	8,409	629 (11)	9,412	214 (26)	4,470	68 (10)	1,601	249 (24)	5,007	213	10,566	4,486 (311)	120,727
—	—	—	—	—	—	—	—	2,526 (6)	70,044	—	—	—	—	1,496 (1)	18,454	200	4,692	6,433 (11)	174,799
240 (2)	9,192	98 (2)	4,020	—	—	—	—	—	—	38 (5)	930	—	—	—	—	142	4,584	1,480 (49)	55,347
—	—	45 (1)	3,662	—	—	18 (1)	310	—	—	—	—	—	—	—	—	5	565	157 (15)	6,721
—	—	—	—	—	—	41 (3)	950	—	—	—	—	—	—	—	—	5	253	277 (11)	6,873
—	—	—	—	—	—	—	—	186 (1)	6,017	46 (1)	1,894	—	—	217 (6)	13,376	36	4,076	769 (16)	41,295
—	—	30 (1)	1,999	321 (1)	14,741	—	—	290 (13)	11,639	135 (1)	2,291	—	—	1 (1)	140	47	2,876	1,153 (43)	45,647
—	—	14 (2)	962	—	—	5 (1)	140	—	—	15 (5)	671	—	—	1,547 (14)	35,803	47	3,606	2,010 (50)	51,696
—	—	118 (4)	11,926	206 (2)	7,674	18 (1)	305	232 (2)	6,140	—	—	—	—	853 (6)	21,253	80	4,561	3,234 (46)	129,064
—	—	100 (6)	4,679	—	—	—	—	—	—	—	—	—	—	193 (10)	6,929	37	4,443	1,039 (51)	41,911
—	—	—	—	—	—	—	—	2,001 (3)	39,671	—	—	—	—	—	—	102	5,312	2,962 (15)	92,889
—	—	—	—	—	—	—	—	370 (1)	16,396	—	—	—	—	35 (2)	2,043	112	7,110	603 (7)	32,594
149 (2)	9,068	270 (8)	9,888	—	—	21 (1)	412	—	—	—	—	—	—	208 (26)	2,348	575	29,180	4,551 (139)	144,651
—	—	232 (9)	11,523	—	—	755 (37)	15,596	3,603 (9)	47,406	773 (44)	13,062	227 (12)	6,058	1,358 (62)	58,055	292	11,050	10,423 (368)	269,963
464 (9)	20,571	2,858 (92)	129,142	527 (3)	22,415	2,271 (70)	44,374	15,080 (101)	301,021	1,889 (275)	37,710	468 (38)	12,029	12,112 (355)	289,145	7,221	280,050	75,913 (2359)	2,234,077
—	—	+49 (−13)	+1,136	—	—	−396 (−)	−6,877	+3,102 (+5)	+5,0718	−372 (−1)	−5,656	— (−2)	—	+305 (−3)	+ 24176	+1075	+5,044	—	—
—	—	−76 (—)	—	—	—	− 4 (—1)	−7,166	+268 (+4)	+9,128	+278 (+2)	+5,650	—	—	−362 (+14)	+14338	−142	− 880	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Figures in parentheses denote number of machines. * Not including machine-tool cutting parts.

and Parts during November, 1957

Other Lathes		Milling Machines		Planing, Shaping and Slotting Machines		Presses and Sheet Metal-working Machines		Other Machines		Machine Tool Parts*		Total	
Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt.	Value £	Quantity. Cwt. and No.	Value £
309 (19)	15,642	1,913 (27)	105,335	1,360 (7)	29,372	6,056 (29)	152,120	3,773(874)	156,384	1,136	60,331	23846 (1105)	987,848
—	—	—	—	—	—	74 (3)	1,442	40 (6)	1,558	9	1,706	473 (11)	17,256
—	—	431 (7)	22,985	1 (1)	75	7 (1)	91	—	—	80	7,358	950 (11)	47,915
100 (1)	5,556	1,086 (8)	52,989	9 (1)	626	355 (9)	10,299	78 (18)	6,676	158	27,167	3,120 (79)	217,489
30 (1)	3,088	58 (2)	15,155	—	—	—	—	230 (9)	25,685	1,158	129,024	3,754 (51)	354,620
179 (3)	3,138	986 (35)	74,112	457 (1)	4,961	772 (17)	20,462	510 (17)	21,153	326	16,923	7,779(119)	258,856
618 (24)	27,424	4,474 (79)	270,576	1,827 (10)	35,034	7,264 (59)	184,414	4631(924)	211,456	2,867	242,509	39922(1376)	1,883,984
—	—	—	—	—	—	—	—	−1 (−1)	−120	—	+110	—	—
—	—	—	−59	—	+97	—	—	—	—	+1	−20	—	—
—	—	—	+85	—	—	—	—	—	—	−11	−8	—	—
+179 (+)	+10,286	—	+2,190	—	—	—	—	+634(+16)	+79,165	−1	−951	—	—
—	—	+831(−2)	−55	—	—	—	—	—	—	—	—	—	—

Figures in parentheses denote number of machines. * Not including machine tool cutting parts.

PRICES OF MATERIALS

All prices per ton except where otherwise stated.

Pig-Iron

Foundry and Forge No. 3, Class 2

Middlesbrough zone	£21 6 0
Birmingham	£20 18 3

Phos. 0·1 to 0·75%

Birmingham	£23 17 0

Scottish Foundry

Grangemouth	£25 3 6

Hæmatite English No. 1

N.E. and N.W. Coast	£25 6 6
Scotland	£25 13 0
Sheffield	£26 15 0
Birmingham	£27 4 0
Welsh	£25 6 6

Steel Products

Medium plates	£46 1 6
Mild steel plates, ordinary*	£42 12 0
Boiler plates*	£45 2 0
†Flat bars 5 in. wide and under; †Round bars under 3 in.	£40 8 0
Billets, rolling quality, soft U.T.	£33 1 6

Phosphor Bronze

Ingots (2B8) (A.I.D.) d/d	£235 0 0

Copper

Cash (mean)	£162 12 6
Cold rolled and hot rolled Sheets 4 ft. by 2 ft. by 10 SWG	£224 15 0—£225 5 0
Rods 3/16 in. to ⅜ in. diam.	£245 15 0
Tubes, 1¼ in. bore by 10 SWG, ton lots, per lb.	2s. 4⅜d.
Wire rod, black, hot-rolled (¼–5/16 in.) English	£178 12 6

Zinc

Refined, minimum 98 per cent. purity, current month (mean)	£63 17 6

Brass

Tubes, solid drawn, per lb.	1s. 4½d.
Strip 63/37, 6 in. by 10 SWG coils, ton lots	£199 15 0—£202 5 0
Rods, ½-3 in. diam. (59 per cent copper)	1s. 7½d.

Yellow Metal

Condenser plates, per ton	£137 0 0
Rods, per lb.	1s. 8½d.

Aluminium

Ingots min. 99·5 per cent Canadian d/d	£197 0 0

Lead

Refined, minimum 99·97 per cent purity, current month (mean)	£74 15 0

Tinplates

‡U.K. Home trade: Handmill f.o.t. makers' works	£3 12 2½
Cold reduced, f.o.t. makers' works	£3 7 10½
U.K. Export: Hot rolled basis, f.o.t. works' port	74s. 0d.—75s. 0d.
Cold reduced basis, f.o.t. works' port	76s. 0d.

Gunmetal

Ingots, 85.5.5.5. ex works	£155 0 0

*N.E. Coast, N. Joint Area, Central Scottish Zone.

†U.T. soft basic.

‡Official maximum price, after allowing for adjustments for increase in price of tin.

MAKERS' PRICES

Hexagon Steel Bars[1]

Sizes in inches from 0·7049 up to 2·21 and 2·41 a/f, ex works basis	£43 4 6
Free cutting black	£47 10 0

Reeled Steel Bars[1]

Single-reeled 1½ in. upwards, f.o.t. works (+ usual extra for sizes)	£43 17 6
Free cutting	£48 2 6

High-Speed Steel

Black random length bar. All prices basic, per lb., subject to extras.

Molybdenum "66"	5s. 10½d.
Molybdenum "46"	5s. 8½d.
14 per cent tungsten	5s. 9d.
16 per cent tungsten	6s. 1½d.
18 per cent tungsten	6s. 4d.
22 per cent tungsten	7s. 5d.
5 per cent cobalt	9s. 6d.
4·75/5·25 per cent molybdenum + 6·0/6·75 per cent tungsten + 1·75/2·05 per cent vanadium (5-6-2)	6s. 0½d.

Precision-ground, High-speed Free-turning Brass Rod[2]

⅛-in. dia. ± 0·00025-in. 2-ton lots, per lb.	2s. 2½d.

Grey Iron Rod

Die Cast[3] in random lengths 18 in. to 24 in. rough machined 1/16-in. above listed size. Extra for definite lengths, for hardenable alloy iron, and for orders of less than £50. Discounts for orders over £150.

	Per cwt. net. Mark I	Mark III
⅜ or ⅞ in.	255s. 6d.	318s. 10d.
1 or 1⅛ in.	204s. 4d.	251s. 10d.
1¼ to 1½ in.	143s. 0d.	171s. 2d.
1⅝ to 2 in.	106s. 2d.	125s. 11d.
2¼ to 3½ in.	91s. 6d.	106s. 4d.
3¾ to 12 in.	86s. 6d.	99s. 2d.

Continuous Cast

10-ft. lengths, centreless machined 1 to 3-in. dia. + 0·010 to 0·020 in., prices as quoted for die cast bar[3]

6-ft. lengths centreless ground + 0·010 in. Extra for hardenable alloy iron[4] Per cwt. net.	⅜ or ⅞ in.	245s. 4d.
	1 or 1⅛ in.	196s. 4d.
	1¼ to 1½ in.	137s. 10d.
	1⅝ to 2 in.	106s. 2d.
	2¼ to 3 in.	91s. 6d.

Stellite[5]

Welding Rods (plain

¼ in. dia. per lb.	30s. 0d.

Toolbits

¼ in. sq. × 4 in., each	22s. 3d.

Precision-ground Mild Steel[2]

1-in. dia. ± 0·00025-in. 4-ton lots, per cwt.	121s. 6d.

1 Colvilles, Ltd., Glasgow, and 17 Grosvenor Street, London, W.1. 2 Pratt, Levick & Co., Ltd., Chester. 3 Sheepbridge Alloy Castings, Ltd., Sutton-in-Ashfield. 4 "Flocast," Harold Andrews Sheepbridge, Ltd., Halesowen. 5 Deloro Stellite, Ltd., Highlands Road, Shirley, Solihull.

BASIC PRICES FROM LONDON STOCK[6]

Free Cutting Steel

Bright cold drawn:

(Usaspead) over 1½ to 2 in.	£59 17 6
Lead bearing (Usaled)	£63 17 6
Precision ground, 1½ in.	£81 12 6

Bright Drawn

M.S. bars (M.M.C.) over 1½ in. to 2 in.	£55 8 6
Square edge flats (Usaflat)	£72 5 0
M.S. angles (Usaspead)	£99 10 0
Casehardening (EN) (Usacase) over 1½ in. to 2 in.	£63 14 6
M.S. bars (EN3B) (Usamild) over 1½ to 2 in.	£57 8 6
Carbon manganese semi-freecutting case hardening (EN202) (Usaspead 202) over 1½ to 2 in.	£71 14 0
35/45 ton tensile (EN6) (Usen) over 1 to 1½ in.	£65 2 6
0·4 Carbon Normalised (Usaspead "40") over 1½ in. to 2 in.	£67 4 6
Carbon manganese steel to Specification EN.16.T (Usaspead 5565), per ton	£127 10 3

Ground Flat Stock

18-, 24-, and 36-in. lengths (Usaspead). List prices less 5 per cent

Oil Hardening Cast Steel

Non-shrink (Usaspead N.S.O.H.) ⅛ in. to 2½ in., per lb.	1s. 11d.
Non-distorting heavy duty (Usaspead H.C.H.C.) ⅛-in. to 2½-in., per lb.	4s. 2d.

Silver Steel

(0·194-in. to 1½-in.) Genuine Stubs quality, per lb.	4s. 6d. less 27½%
M.M.C. quality, per lb.	2s. 5d. + 6½%
Boxes of 16 assorted sizes 1/16-in. to ⅛-in. dia.	7s. 6d.

Stainless Steel

K.E. 40.AM (Freecutting), per lb.	3s. 3½d.

Glacier Machined Bronze Bars

Phosphor bronze (2B8); Lead bronze	Prices on application

High-speed Steel

18 per cent. tungsten. Prices on application.

Toolholder bits:

Usaspead "Super"; " "Supreme"; " Cobalt 10	List price

Shimstock

Steel assorted, per tin	3s. 6d.
Brass " "	7s. 3d.

6 Macready's Metal Co., Ltd., Pentonville Road, N.1. Subject to confirmation by London Office. Delivered free by van in London area.